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GUIDE TO THE ADULT AND LARVAL PLUSIINAE OF CALIFORNIA (LEPIDOPTERA: NOCTUIDAE)

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A GUIDE TO THE ADULT AND LARVAL PLUSIINAE OF CALIFORNIA

(LEPIDOPTERA: NOCTUIDAE)

By

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INTRODUCTION

The Plusiinae occur in all major climatic regions of the world. The California plusiine fauna consists of 27 species, including 3 endemics, or about 40% of the 71 North American species, and 15 of the 18 genera, which is approximately 82% of the genera in North America.

The larval forms, mostly referred to as loopers or semiloopers, are leaf feeders. They are known to cause damage to forest and shade trees, field crops, garden vegetables, grasses, ornamental herbs and greenhouse plants. Several of the species are important pests of the State's agricultural production, such as the cabbage looper, soybean looper, alfalfa looper, celery looper, bean leaf skeletonizer and others to varying degrees. This paper has been prepared in order to document the California plusiines and particularly to serve as a guide for the identification of the late instar larval and adult stages.

Emphasis has been placed on the keys and figures to facilitate easy and accurate species identification. The key to the larvae is reinforced with simple line drawings, illustrating dicotomus characters in a couplet. At the end of the publication are illustrations of pertinent genitalic structures and larval characters, California maps showing distribution records, and photographs of the adults. The photographs are shown in color in order to present the adult patterns, which are the easiest and most useful features for differentiating species. An index to host plants is provided for quick reference. Food plant data were collected from the following sources: specimen labels; host files maintained by California Department of Food and Agriculture Lepidopterists; information reported by Crumb (1956), Forbes (1954), Prentice (1962), and Tietz (1936).

The California distributions of each species reflect data collected from specimens in the larger collections in the State. The maps provided give an indication of the general areas in which the species occur.

MORPHOLOGY

Adult plusiines are easily recognized by the presence of strong thoracic and abdominal tufts, and characteristic gold or silver markings on the forewings, especially in the form of a stigma below the orbicular spot and an accompanying silver or gold spot. These markings are quite variable and must be used cautiously for identification purposes. Refer to the labeled figures at the end of this paper for details of adult wing maculation, genitalia and larval morphology.

With the exception of species of *Mouralia* Walker and *Abrostola* Ochsenheimer, the caterpillars have three pairs of well-developed prolegs, one on each of segments 5, 6 and 10. The keys provided for the differentiation of late instar larvae are basically a modification of a previous effort by Eichlin and Cunningham (1969).

The characters most frequently used are chaetotaxy and head structures, such as the mandibles, and a small, unique, minutely ridged sclerite found laterally on the hypopharynx and referred to as the *raduloid.* This latter structure can be viewed after first deflecting or removing the maxillary palpus. The raduloid is characteristic of the Plusiinae but has been found on a few species in closely related groups. In nature the caterpillars are usually a shade of green with narrow, longitudinal bands of white or pale yellow, the color patterns are quickly lost following preservation.

BIOLOGY

The adults of most species are basically nocturnal and come to lights readily, but many are also diurnal. The boreal forms, found at high elevations in California, are characteristically diurnal.

In species with obligate winter diapause, this period is spent as a third instar larva. This has been observed both in the field and in the lab. *Mouralia* and *Abrostola,* are exceptions and diapause as pupae. The average duration of the life cycle in the laboratory from egg to adult is 30 days. There are 5 larval instars, except in *Pseudoplusia includens* (Walker), which has 6. The duration of each stage is as follows: egg, 3-8 days; each larval instar, 3-5 days; prepupa, 1-2 days; pupa, about 8 days. Pupation takes place on the underside of a suitable leaf, usually of the host plant, but if, for instance, the host's leaves are too narrow, the larva may tie a few leaves together or select a larger leaf on a neighboring non-host plant. Pupation occurs in a thin-walled cocoon, perhaps only 2 layers in thickness; often the pupa is plainly visible.

With every species from which I was able to obtain eggs, it was possible to rear at least one generation through on an artificial diet which was a modification of the bean-yeast, agar base preparation reported by Shorey and Hale (1965). Most late instar larvae used for this study were reared. The keys and descriptions have been checked against both field collected and reared specimens whenever possible.

The adult females attract males with pheromones and usually begin mating the second day following emergence. Multiple mating is common, as evidenced by the frequent occurrence of several spermatophores in the corpus bursae.

CLASSIFICATION

The classification of McDunnough (1944) has been followed. No changes in classification have been incorporated here. However, Hugh B. Cunningham, Auburn University, Alabama, and myself are in the process of revising the fauna north of Mexico, and will introduce changes in the classification of the Plusiinae.

ACKNOWLEDGEMENTS

I extend my appreciation to the following individuals and institutions for permitting me to examine their material: P. Arnaud, California Academy of Sciences, San Francisco; J. P. Donahue and Charles L. Hogue, Los Angeles County Museum of Natural History; R. H. Leuschner, Manhattan Beach, California; David L. Bauer, South Lake Tahoe, California; L. D. Anderson, University of California, Riverside; J. A. Powell, University of California, Berkeley; R. L. Schuster, University of California, Davis.

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A KEY TO THE GENERA OF CALIFORNIA PLUSIINAE ADULTS

1. Forewing with areas of raised scales 2
   Forewing smoothly scaled 3
2. Length of forewing more than 15 mm. . . . . *Mouralia*
   Length of forewing less than 15 mm. . . . . *Abrostola*
3. All tibiae spined, or hind tibiae spined on terminal portion, or with a few weak spines between spurs 4
   No tibiae spined 8
4. Outer margin of forewing straight or slightly concave . . . *Autoplusia*
   Outer margin of forewing convex 5
5. All tibiae spined, perhaps strongest on midtibia 7
   Spines only between spurs on hind tibia 6

6. Forewing with antemedial line (am.) smoothly curved inward toward wing base . . . . . *Anagrapha*
Forewing with am. line curved outward away from wing base . . . . . *Syngrapha*

7. Hind wings with yellow . . . . . *Caloplusia*
Hind wings without yellow . . . . . *Rachiplusia*

8. Forewing with st. (subterminal) line having a sharp inward tooth in cell R5 as well as above and below, preceded by black dashes in cells R4 to M2; abdomen of males with lateral scale tufts caudad . . . . . *Trichoplusia*
Forewing not as described above; abdomen of males without lateral scale tufts caudad 9

9. Labial palpi curved outward at tip . . . . . *Polychrysia*
Labial palpi not curved outward at tip, directed dorsad 10

10. Third segment of labial palpi extending well above apex, acuminate; forewing with outer margin excised behind apex . . . . *Pseudeva*
Third segment of labial palpi shorter, rounded apically; forewith with outer margin behind apex straight or rounded 11

11. Dorsal abdominal tufts lacking or greatly reduced . . . . *Chrysaspidia*
Dorsal abdominal tufts well developed, especially on the third segment 12

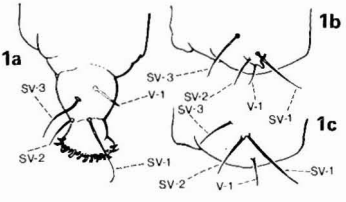
12. Forewings with well-developed, silver or gold metallic sign 13
Forewing without well-developed metallic sign 14

13. Forewings with copper iridescence . . . . . *Pseudoplusia*
Forewings without copper iridescence . . . . . *Autographa*

14. Forewings with outer margin behind apex straight, with ground color gray . . . . . *Adeva*
Forewings with outer margin behind apex rounded, with ground color brown . . . . . *Plusia*

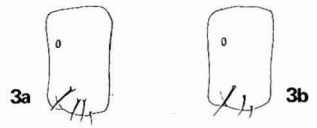
KEY TO THE KNOWN SPECIES OF CALIFORNIA PLUSIINE LARVAE

1. Prolegs present on abdominal segments 3 and 4 (1-a) 2
Prolegs vestigial (1-b) or absent (1-c) on abdominal segments 3 and 4 . . . 3

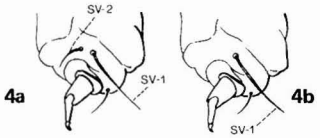


2. Mandible with wide gap between dentes 2 and 3 . . . . *Mouralia tinctoides*
Mandible without wide gap between dentes 2 and 3 . . *Abrostola urentis*

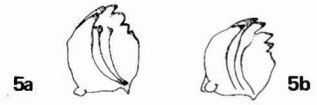
3. Seta SV-2 present on abdominal segment 1 4
Seta SV-2 absent on abdominal segment 1 8



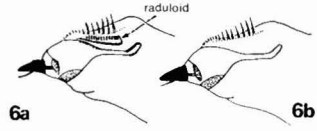
4. Setae SV-1 and SV-2 present on meso- and metathorax . . . . *Syngrapha celsa, Syngrapha alias**
Setae SV-2 absent on meso- and metathorax 5



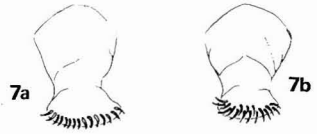
5. Ribs 2 and 3 of mandible terminating in processes before reaching cutting margin . . . . . *Autographa ampla*
Ribs 2 and 3 of mandible not terminating in process but continuing to cutting margin . . 6



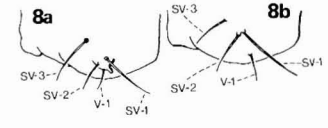
6. Raduloid present . . . . . *Autographa corusca*
Raduloid absent 7



7. Crochets uniordinal; ventral edge of mandible curved inward . . . . . *Chrysaspidia putnami*
Crochets biordinal; edge of mandible not as above . *Anagrapha falcifera*



8. Vestigial prolegs present on abdominal segments 3 and 4 9
Vestigial prolegs absent on abdominal segments 3 and 4 11



9. Ribs 2 and 3 not terminating in processes, but continuing to cutting margin . . . . . *Trichoplusia ni*
Ribs 2 and 3 terminating in processes before reaching cutting margin 10

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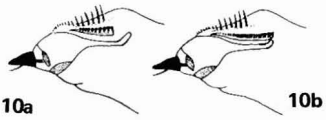
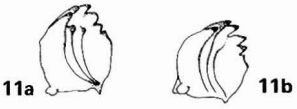
* *Syngrapha celsa* and *S. alias* could not be separated at least on the basis of characters used in this study. They both occur in the northwest corner of the State, but only *S. celsa* is currently known from other mountainous areas of Northern California.

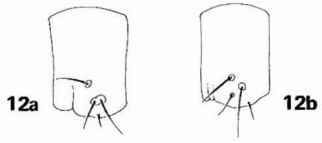
10. Raduloid with 10 minute ridges . . . . . *Pseudoplusia includens*
Raduloid with 23 minute ridges . . . . . *Trichoplusia oxygramma*



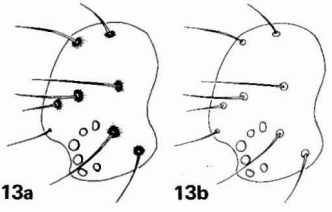
11. At least one rib of mandible terminating in process before reaching cutting margin 12
None of ribs of mandible terminating in processes, but continuing to cutting margin 15



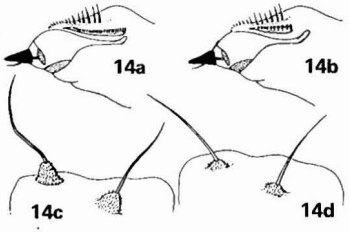
12. Pinacula of setae SV-1 and SV-2 at least partially fused on abdominal segment 2; raduloid absent . . . . . *Polychrysia morigera*
Pinacula of setae SV-1 and SV-2 separated on abdominal segment 2; raduloid present 13



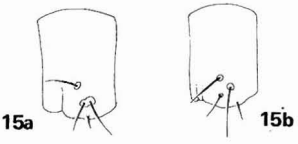
13. Head with setal pinacula ringed with black 14
Head with setal pinacula not ringed with black . . . . . *Plusia aeroides*



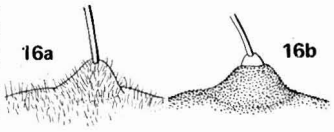
14. Raduloid with 23 minute ridges (14a); dorsal abdominal setae on protruding conical pinacula (14c) . . . . . *Autoplusia olivacea*
Raduloid with 12 minute ridges (14b); dorsal abdominal setae without strongly prominent pinacula (14d). . . . . *Autoplusia egena*



15. Pinacula of setae SV-1 and SV-2 at least partially fused on abdominal segment 2 16
Pinacula of setae SV-1 and SV-2 separated on abdominal segment 2 . . . . . *Rachiplusia ou*



16. Integument with microspines . . . . . *Autographa biloba*
Integument without microspines, but with minute granules . . . . . *Autographa californica*



ABROSTOLA OCHSENHEIMER 1816:88

KEY TO ADULT CALIFORNIA *ABROSTOLA*

Forewings with pm. line strongly incurved, crescent-shaped on posterior one-half . . . . . *parvula*

Forewings with pm. line nearly straight, only slightly curving . . . . *urentis*

ABROSTOLA URENTIS GUENEE
(Figs. 5, 6, 59)

Abrostola urentis Guenee 1852:322.

Adult: Forewing length 13-15 mm. Ground color dark gray, black outlines of am. and pm. lines, orbicular, suborbicular and reniform spots of black raised scales; am. line double, brown, lined outside with black, slightly excurved; pm. line double, brown, lined inside with black on posterior one-half, medially straight, outward curved at anal margin; st. line pale, weak except wing apex where it passes through short, black apical dash and short black, oblique shading to apex; normal spots large, pale; orbicular ovate; suborbicular from posterior end of orbicular, slightly outward; reniform kidney-shaped. Hind wing fuscous, paler on basal one-half; fringe white. Male genitalia: Valve (fig. 5); uncus long, thin, pointed, unspined; vinculum broadly rounded; aedeagus spinose apically, apical sclerotized, bifurcate plate with 2 sharp spines laterad and cluster of 4 small cornuti, adjacent to cluster of 12 cornuti. Female genitalia: (fig. 6) eighth abdominal segment with 2 outward projecting pouches latero-cephalad; ostium bursae wider than long, expanded laterad, sclerotized, granulose; ductus bursae narrow caudad, variously sclerotized, bending sharply laterad, then cephalad, gradually expanding to double width; corpus bursae obovate, strigate caudad. Flight period: May to June, August.

Larva: Prolegs present on abdominal segments 3-6, slightly reduced, thinner, on 3; SV-2 absent on first abdominal segment, meso-and metathorax; second abdominal segment with SV-1 and SV-2 separated; crochets 20-28; integumental microspines absent; head reticulate; mandible with processes on rib 2; raduloid ridges 16; abdominal segment 8 gibbose subdorsad.

Distribution: Nova Scotia to British Columbia; United States, except for Southeast; no verified records for California.

Host plants: Urtica diotica (stinging nettle); *U. Lyalli* (lyall nettle).

COMMENTS

Although no specific records of *A. urentis* from the State have been seen, it was reported by Crumb (1956). This species is more common in northern portions of its range and perhaps will also be found in Northern California.

ABROSTOLA PARVULA BARNES AND McDUNNOUGH

(Figs. 7, 8, 60; Map 4)

Abrostola parvula Barnes and McDunnough 1916:225.

Adult: Forewing length 10-12 mm. Ground color gray, darkest between am. and pm. lines, shading in band from apex to anal margin outside pm. line and inside st. line, strongest in posterior one-half, anterior one-half of subterminal area gray-white with 3 or more narrow black dashes; t.l. black near posterior end of outer margin; some transverse black lines of raised scales on am. and pm. lines and variously on spots; am. and pm. lines double, smooth, pm. line incurved on posterior one-half; normal spots large, pale; orbicular, suborbicular fused, oblique; reniform diffused outward. Hind wing fuscous. Male genitalia: Valve (fig. 7); uncus pointed, lacking terminal spine; aedeagus with small spine-like cornuti in apical patch. Female genitalia: (fig. 8) Ostium bursae short, membranous pouch wide, extensions latero-caudad lightly sclerotized, cup-shaped lateral pockets; ductus bursae short, membranous, curving laterad to corpus bursae; corpus bursae small, oval, sac-like; signum a sclerotized pigmented plate dorsad of entrance of ductus bursae; ductus seminalis arising latero-caudad on corpus bursae. Flight period: August to October.

Larva: Unknown.

Distribution: Arizona and California.

Host plant: Unknown.

COMMENTS

This species resembles a small specimen of *A. urentis* but differs in genitalic characters. It occurs at lower elevations in desert regions.

MOURALIA WALKER 1852:1803

MOURALIA TINCTOIDES (GUENEE)

(Figs. 9, 10, 61, 88; Map 4)

Abrostola tinctoides Guenee 1852:323

Adult: Forewing length 18-22 mm. Ground color gray-brown, black on am. and pm. lines, outlining spots formed of raised scales (as *Abrostola* species); pale area covering outer margin from apex obliquely to pm. line at anal margin, pale spot between am line and wing base toward anal

margin and normal spots pale within; am. and pm. lines smooth, double; all spots large; orbicular smaller, fused to suborbicular forming oblique figure 8; reniform largest, suboval; st. line pale, evenly dentate, passing through one or two short apical dashes. Hind wing fuscous, pale on basal one-third; fringe white. Male genitalia: Valve (fig. 9); uncus C-shaped, base broad, apex with minute curved spine, basal three-fourths flat on top, wider at middle from which arises cluster of hair-like scales; juxta simple, shield-like; vinculum short, broadly rounded; aedeagus short, small cornutus on broad rounded base apically, club-shaped projection covered with small, broad spines. Female genitalia: (fig. 10) Ostium bursae short, broad, sclerotized, partially strigate, leading directly into corpus bursae; corpus bursae two membranous sacs, one produced anteriorly into elongate, narrow fundus, other produced anteriorly into shorter apex, slightly spiculate; ductus seminalis arising near tip of apex of corpus bursae. Flight period: multivoltine, adults flying all year.

Larva: prolegs present on abdominal segments 3-6, slightly reduced on 3; abdominal segment 8 gibbose subdorsad; SV-2 absent on first abdominal segment, meso- and metathorax; SV-1 and SV-2 separated on second abdominal segment; crochets 20-28; integumental microspines absent; mandible with mesal processes on rib 2, wide gap between dentes 2, 3; head reticulate, raduloid ridges 16.

Distribution: Florida, Texas, California; south to tropics.

Host plants: Tradescantia fluminensis (spiderwort or wandering Jew, in part); *Zebrina pendula* (wandering Jew, in part).

COMMENTS

The listing of *Zebrina pendula* as a host species may be in error, the result of a possible misassociation of the common name (wandering Jew) with the scientific name. *Mouralia tinctoides* is basically a tropical species, nondiapausing, and occurs only in subtropical-type climates in the northernmost portions of its range.

TRICHOPLUSIA McDUNNOUGH 1944:204

KEY TO ADULT CALIFORNIA *TRICHOPLUSIA*

Ground color of forewings uniformly gray-black; stigma simple, pointed . . . . . *oxygramma*

Ground color of forewings mottled gray; stigma variously rounded, with accompanying spot . . . . . *ni*

TRICHOPLUSIA NI (HUBNER)
Cabbage Looper

(Figs. 11, 12, 62, 86; Map 1)

Noctua ni Hubner [1800-1803] : 58, fig. 284.

Adult: Forewing length 16-18 mm; ground color luteus, heavily shaded, mottled with various shades of gray and gray-black, some light brown

outward, lacking iridescence; stigma usually U-shaped with rounded silver dot attached or separated; st. line dark, anteriorly with 3 black dashes projecting basad, posteriorly with sharp dentations; other lines usually weak, doubled. Hing wing fuscous. Abdomen of male with long, straw colored scale tufts laterally on segment 5, projecting posteriorly. Male genitalia: Valve (fig. 11); vinculum long, tapered to point; aedeagus without cornuti. Female genitalia: (fig. 12) Ostium bursae small, ovoid; ductus bursae 4-5 times length of corpus bursae, narrow, ribbon-like and strigate; corpus bursae with narrow, bluntly pointed apex; ductus seminalis arising from apex of corpus bursae.

Larva. Vestigial prolegs on abdominal segments 3 and 4, appearing as minute peg-like structures; SV-2 absent on first abdominal segment, and meso- and metathorax; D-2 equidistant from D-1 and SD-2 on mesothorax; SV-1 and SV-2 separated on abdominal segment 2, and together with SV-3, all about equidistant; crochets 19-22; no microspines; no subterminal processes on ribs of mandible; raduloid ridges 10.

Distribution: Southern Canada and United States, south to the tropics; throughout California.

Host plants: Polyphagous. The following plants have been recorded as hosts of *T. ni: Acacia greggii* (catclaw); *Ageratum conyzoides; Althaea rosea* (hollyhock); *Antirrhinum* sp. (snapdragon); *Apium graveolens* (celery); *Argemone platyceras* v. *hispida; Asclepias* sp. (milkweed); *Asparagus officinalis* (garden asparagus); *Bergenia* sp.; *Beta vulgaris* (beets); *Brassica campestris* (field mustard); *B. hirta (alba)* (white mustard); *B. napus* (rape or colza); *B. nigra* (black mustard); *B. oleracea* varieties (broccoli, brussel sprout, cabbage, cauliflower); *B. rapa* (turnip); *Calendula officinalis* (pot marigold); *Chaenactis stevioides; Chaenomeles japonica* (dwarf Japanese quince); *Chenopodium album* (lambs quarters); *Chrysanthemum* sp.; *Cineraria* sp.; *Citrullus vulgaris* (watermelon); *Citrus sinensis* (sweet orange); *Citrus* sp.; *Coleus* sp.; *Crepis* sp. (hawksbeard); *Crotalaria rotundifolia; Cucumis melo* (melon); *C. sativus* (cucumber); *Cucurbita maxima* (autumn and winter squash); *C. pepo* (zuccini squash); *Daucus carota* (carrot); *Dianthus caryophyllus* (carnation); *Erodium cicutarium* (red-stem filaree); *Erodium* sp. (heronsbill); *Eschscholzia californica* (California poppy); *Euphorbia pulcherrima* (pointsettia); *Fragaria* sp. (strawberry); *Geranium* sp. (geranium); *Gossypium* sp. (cotton); *Helianthus* sp. (sunflower); *Hibiscus esculentus* (okra); *Ipomoea purpurea* (common morning glory); *Lactuca canadensis; L. sativa* (lettuce); *L.* sp. (wild lettuce); *Lathyrus odoratus* (sweet pea); *Lupinus* sp. (lupine); *Lycopersicon esculentum* (tomato); *Malva* sp. (mallow); *Medicago sativa* (alfalfa); *Mentha* sp. (mint); *Nicotiana glauca* (tree tobacco); *N. tobaccum* (tobacco); *N. trigonophylla; Papaver* sp. (poppy); *Pastinaca sativa* (cultivated parsnip); *Pectis papposa* (chinch weed); *Petunia* sp. (petunia); *Phaseolus limensis* (lima beans); *P. lunatus* (sieva bean); *P. vulgaris* (kidney bean); *P.* sp. (beans); *Philodendron* sp.; *Pisum sativum* (garden pea); *Plantago* sp. (plantain); *Rhaphanus sativus* (radish); *Reseda odorata* (common mignonette); *Salvia* sp. (sage); *Senecio mikanioides* (German ivy);

Smilax rotundifolia (horse brier); *Solanum tuberosum* (potato); *Spinacea oleracea* (spinach); *Taraxacum officinale* (common dandelion); *Tribulus* sp. (puncture weed); *Trifolium* sp. (clover); *Tropaeolum majus* (garden nasturtium); *Vigna sinensis* (cowpea); *Zea mays* (corn).

COMMENTS

Trichoplusia ni is a widespread, extremely adaptable, multivoltine species capable of feeding on a wide assortment of plant species. Consequently, it is a pest many places in temperate and tropical regions worldwide.

TRICHOPLUSIA OXYGRAMMA (GEYER)

(Figs. 13, 14, 63)

Autographa oxygramma Geyer 1832:37, figs. 769, 770.

Adult: Forewing length 16-18 mm, ground color mostly gray-black, darker around stigma and toward apical margin; slightly glossy; lines obscure, except pale am. and pm. lines; pm. line dentate; stigma oblique, pale, trapezoidal, thinly outlined with silver, no accompanying spot; oblique pale streak continuing to costa through orbicular. Hindwing fuscous, becoming paler on basal one-half. Male abdomen with gray, scale tufts laterally. Male genitalia: Valve (fig. 13); vinculum long, tapered to point; aedeagus with long, needle-like basal cornutus, and curved elongate sclerotized patch apically. Female genitalia: (fig. 14) Ostium bursae a short membranous pouch, about 3 times wider than long; ductus bursae 3-4 times length of corpus bursae, entering into thickened membranous pouch on corpus bursae; corpus bursae with narrowed tapered apex; ductus seminalis arising from apex of corpus bursae. Flight period: August to October.

Larva: Vestigial prolegs on abdominal segments 3 and 4, appearing as minute peg-like structures; SV-2 absent on first abdominal segment and meso- and metathorax; D_2 closer to D_1 than to SD-2 on mesothorax; crochets 22-25; mandible with ribs 2 and 3 terminating in processes before reaching cutting margin; raduloid with 23 ridges; dark lateral stripe on head (if present) excluding ocelli 1-4.

Distribution: Eastern one-half of United States, and in the Southwest to California (?) and south to tropics.

Host plants:Aster sp., *Solidago* sp. (golden rod), *Erigeron canadensis, Nicotiana tabaccum* (tobacco).

COMMENTS

I have not been able to verify *T. oxygramma's* presence in California, although it has been recorded by Forbes (1954).

PSEUDOPLUSIA McDUNNOUGH 1844:206

PSEUDOPLUSIA INCLUDENS (WALKER)
Soybean Looper

(Figs. 15, 16, 64; Map 10)

Plusia includens Walker 1857:94.

Adult: Forewing length 15-18 mm; ground color brown with coppery iridescence, darkest just above stigma, palest from base to am. line; am. line fairly straight and oblique; pm. line double, strongly indented, bidentate between Cu_2 and 2A; stigma oblique, U-shaped; silver spot subequal to stigma, mostly separated but occasionally joined to stigma; oblique pale streak from stigma to costa, including orbicular; st. line often obscured on posterior one-half by iridescence. Hind wing fuscous. Male genitalia: Valve (fig. 15); vinculum extremely narrow, tapering to point; aedeagus expanded on both ends, apex spinose; cornutus at ejaculatory duct and basal patch of small cornuti. Female genitalia: (fig. 16) Ostium bursae shallow, flared laterad, strigate and shagreened cephalad; ductus bursae constricted at middle, posterior one-half membranous, anterior portion near corpus bursae somewhat sclerotized, strigate; corpus bursae an elongate sac, with extremely elongate, narrow apex, which nearly projects around the circumference of corpus bursae; ductus seminalis arises from apex of corpus bursae.

Larva: Vestigial prolegs on abdominal segments 3 and 4, appearing as minute peg-like structures; SV-2 absent on first abdominal segment, and meso- and metathorax; D-2 closer to D-1 than to SD-2 on mesothorax; crochets 22-25; no integumental microspines; mandible with subterminal processes on ribs 2 and 3; raduloid with 10 ridges; head with or without dark lateral band, which excludes ocelli 1-4.

Distribution: Southeastern Canada and eastern one-half of United States, south to Florida and tropics, and west to California.

Host plants: Polyphagous. Known from the following: *Brassica oleracea; Chrysanthemum* sp. ("pom pom" chrysanthemum); *Coleus* sp.; *Commelina* sp. (day-flower); *Croton capitatus; Eupatorium* sp. (thoroughwort); *Glycine max* (soybean); *Gossypium hirsutum* (upland cotton); *Hibiscus esculentus* (okra); *Lactuca sativa* (lettuce); *Lantana* sp.; *Lycopersicon esculentum* (tomato); *Medicago sativa* (alfalfa); *Nicotiana tabaccum* (tobacco); *Pelargonium* sp. (storksbill); *Persea americana* (avocado); *Phaseolus* sp. (beans); *Solidago* sp. (goldenrod); *Tradescantia fluminensis* (spiderwort or wandering Jew); *Zebrina pendula* (wandering Jew).

COMMENTS

Pseudoplusia includens appears restricted in its range to the southern Coastal Plain of California. Its polyphagous nature makes me feel that it should range over a much broader area of the State, particularly in agricultural regions, such as the Central Valley, and other areas disturbed by man's influence. The limited records indicate that the population along the lower coast is at least bivoltine, with adults active in June and July and again in September and October. It is thought that polyphagous habits among Lepidoptera allow multivoltinism within populations of those species where climatic conditions will permit (Opler and Buckett, 1971; Shapiro, 1974). *Pseudoplusia includens* and the other polyphagous plusiine species provide evidence supporting that contention. Though closely related to *Trichoplusia ni, P. includens* males lack the lateral abdominal scale tufts.

AUTOPLUSIA McDUNNOUGH 1944:203

KEY TO ADULT CALIFORNIA *AUTOPLUSIA*

Ground color of forewings brown ..... *egena*

Ground color of forewings dark green ..... *olivacea*

AUTOPLUSIA EGENA (GUENEE)

Bean Leaf Skeletonizer

(Figs. 17, 18, 65; Map 6)

Plusia egena Guenee 1852:328.

Adult: Forewing length 17-20 mm. Ground color light brown, dark reddish-brown with coppery iridescence between am. and pm. lines, below stigma, with a diffuse patch from outside pm. line at CU_1, obliquely to wing apex and outward to wing margin at CU_2; st. line black in latter diffuse dark patch, outwardly bidentate between M_3 and CU_2; am. line slightly oblique, straight; pm. line oblique, fairly smooth, single, thin, fuscous; orbicular ovate; reniform oblong, faint; stigma very weak, thinly silvered, broad, squat, somewhat U-shaped, often slightly produced at lower, outer portion. Hind wing dull fuscous, lighter basally. Male genitalia: Valve (fig. 17); uncus slender, without spine; tegumen slender; juxta narrow; aedeagus longer than valve, apex not spinose, small cornuti in basal two-thirds and one long, thick cornutus apically. Female genitalia: (fig. 18) Ostium bursae dorso-ventrally compressed, broad, sclerotized, punctate, ventro-caudal margin elongate, produced ventrad, cephalic portion curving ventrad; ductus bursae shaped like ostium bursae, ribbon-like, strigate on right side, entering corpus bursae ventrally far cephalad of apex; apex of corpus bursae elongate, flattened, about as wide

as ductus bursae, strigate and twisted to ventrad of ostium bursae, apical margin truncate; ductus seminalis arising from apex of corpus bursae; remainder of corpus bursae small, granulose. Flight period: multivoltine, adults flying all year.

Larva: No vestige of prolegs on abdominal segments 3 and 4; SV-2 absent on first abdominal segment and on meso- and metathorax; second abdominal segment with SV-1 about equidistant from SV-2 and V-1; fourth abdominal segment with V-1 closer to SV-2 than V-1 setae are to each other; mesothorax with D-2 equidistant from D-1 and SD-2; crochets 24-26; minute integumental microspines present; head with black annuli around setal bases; mandible with subterminal process on rib 2 and occasionally on 3; raduloid with 12 ridges.

Distribution: Florida, New Mexico, California (probably also Texas and Arizona - unconfirmed); south to tropics; California.

Host plants: Agapanthus sp.; *Althaea rosea* (hollyhock); *Apium graveolens* (celery); *Brassica oleracea* varieties; *Chrysanthemum frutescens* (marguerite); *C.* sp.; *Daucus carota*(carrot); *Delphinium* sp. (larkspur); *Glycine max* (soybean); *Malva* sp. (mallow); *Mentha spicata* (spearmint); *M.* sp. (mint); *Phaseolus limensis* (lima beans); *Phaseolus vulgaris* (kidney beans); *P.* sp.; *Senecio* sp. (groundsel); *Symphytum* sp. (comfrey); *Tagetes erecta* (big marigold); *Verbena* sp. (verbena).

COMMENTS

This is a tropical nondiapausing species occurring in North America where the climate is appropriate for continuing generations. In warm seasons it migrates into the Central Valley, producing several generations before colder weather arrives. *Autoplusia egena* can find suitable host plants at different times of the year, because of its polyphagous nature.

AUTOPLUSIA OLIVACEA (SKINNER)

(Figs. 19, 20, 66; Map 5)

Autgrapha olivacea Skinner 1917:329.

Adult: Forewing length 18-22 mm. Similar to *A. egena* but ground color gray, dark areas brown-black, olive-green reflections with slight coppery iridescence; dark areas between am. and pm. line, below stigma and covering most of anterior two-thirds of outer area of wing beyond pm. line; st. line black, dentations between M_3 and CU_2 somewhat obscured by shading; am. and pm. lines fairly smooth, oblique, nearly parallel (as with *A. egena*); stigma thinly silvered, broadly open at upper base, flattened at bottom, outer angle variously produced as short silver line; obicular faintly visible, ovate; reniform faintly visible or obscure, oblong. Hind wing fuscous, slightly paler toward base. Male genitalia: Uncus slender without spine; tegumen slender; valve (fig. 19); juxta narrow,

aedeagus longer than valve, apex spinose, many small cornuti in basal one-half, long, thick cornutus apically. Female genitalia: (fig. 20) Ostium bursae broad, length twice width, membranous dorsally, uniformly sclerotized ventrally; ductus bursae slightly wider and longer than ostium bursae, dorso-ventrally compressed, evenly sclerotized, entering corpus bursae ventrad; corpus bursae narrow, elongate, S-shaped from dorsal aspect, apex rounded with rugose strigae; ductus seminalis arising from apex of corpus bursae. Flight period: multivotine, adults flying all year.

Larva: Similar to *A. egena;* no vestige of prolegs on abdominal segments 3-4; SV-2 absent on first abdominal segment, meso- and metathorax; second abdominal segment, SV-1 about equidistant from SV-2 and V-1; fourth abdominal segment, V-1 setae as close to each other as V-1 is to SV-2, or slightly closer to SV-2; mesothorax, D-2 equidistant from D-1 and SD-2; crochets 19-25; integumental microspines present; head with black annuli around setal bases; rib 2 and often rib 3 of mandible with subterminal process; raduloid ridges 23 (12 on *A. egena*); setal pinacula conical (more protruding than *A. egena*).

Distribution: California.

Host plants: Heliotropium sp. (heliotrope); *Lantana* sp.; *Mimulus cardinalis* (scarlet monkey flower); *Phaseolus limensis* (lima beans); *P. vulgaris* (kidney beans); *Senecio jacobaea* (tansy ragwort); *Senecio* sp. (groundsel).

COMMENTS

Autoplusia olivacea is closely related to *A. egena.* The two species are sympatric in California, utilize some of the same host plants and are biologically similar. *Autoplusia olivacea* resembles *A. egena* except for its greenish color; however, the morphology of the male and female genitalia is distinct. This species has a coastal distribution, extending from the San Francisco Bay area southward to San Diego County, and is endemic to California.

RACHIPLUSIA HAMPSON 1913:410

RACHIPLUSIA OU (GUENEE)

(Figs. 21, 22, 67; Map 10)

Plusia ou Guenee 1852:348.

Adult: Resembles *Autographa californica,* but with some spines on all tibiae. Forewing length 16-22 mm. Ground color various shades of gray, some sheen on outer one-half, darkest between am. and pm. lines particularly above stigma, some dark shading from apex across st. line, palest area along outside margin of pm. line, pale band expanded to costa; am. line double, medially outcurved; pm. line double, sinuous, dentation, if present, weak; st. line jagged, contrasting black on upper portion,

weaker on lower portion; stigma U-shaped, margin silver, round silver spot usually separate but often attached to lower outside portion of stigma; orbicular partially obscured in pale gray streak from stigma to costa; reniform usually weak, pale lined but variously outlined with black. Hind wing dull luteus, becoming fuscous outward. Male genitalia: Valve (fig. 21); vinculum of uniform width, apex truncate; juxta pointed apically; aedeagus thick; three groups of small aedeagal cornuti, basal group with 3, two mesal groups with 3-6. Female genitalia: (fig. 22) Ostium bursae broad, dorso-ventrally compressed, sclerotized, grooved on both sides, bilobed caudo-ventrad; ductus bursae with caudal section narrow, membranous, leading to short, sclerotized section, then membranous, again becoming sclerotized as it expands to corpus bursae; corpus bursae with well-defined small fundus, cephalic one-half shagreened, caudal one-half partially sclerotized, strigate; apex of corpus bursae curved over ductus bursae; ductus seminalis arising from sclerotized bulge on apex of corpus bursae. Flight period: multivoltine, adults flying all year.

Larva: No vestige of prolegs on abdominal segments 3-4; SV-2 absent on first abdominal segment, meso- and metathorax; SV-1 and SV-2 separated on second abdominal segment; fourth abdominal segment, V-1 setae as close to each other as V-1 is to SV-2, or slightly closer to SV-2; crochets 20-22; dark microspines on integumen, number highly variable, usually concentrated on venter and base of SD-2 pinaculum; head with dark lateral stripe (if present), not including ocelli 1-4; ribs of mandible lacking subterminal processes; raduloid with 10 ridges.

Distribution: United States, except northeastern states.

Host plants: Chenopodium ambrosioides; Cosmos sp. (cosmos); *Mentha* sp.; *Nicotiana tobaccum* (tobacco); *Trifolium* sp. (clover); *Triticum aestivum* (wheat); *Tropaeolum* sp. (nasturtium).

COMMENTS

Surprisingly few records of *R. ou* were found for California, considering it has multiple broods in other parts of its range and is polyphagous. It is a tropical species and thought to migrate from the southern states northward during the summer and fall. Like *Pseudoplusia includens,* it appears to be less successful in California than elsewhere in its range.

PLUSIA OCHSENHEIMER 1816:89

PLUSIA AEROIDES GROTE

(Figs. 23, 24, 68)

Plusia aeroides Grote 1864:83.

Adult: Forewing length 15-17 mm. Ground color dull orange-brown, pinkish tint on fresh specimens, somewhat shaded band over st. line area; lines single, fuscous, prominent; thin, fuscous band between b.l. and am.

lines; am. line nearly vertical, straight; pm. line sharply turned inward to costa, then slightly, gradually curving inward from CU_1 to CU_2, then straight, splitting into two golden-yellow lines to anal margin, golden-yellow on outside margin of pm. line; st. line strongly dentate; median line often extending from reniform to anal margin; orbicular obscure; suborbicular present, kidney bean-shaped, fuscous outlined; no stigma; reniform visible, constricted somewhat at middle, fuscous outlined. Hind wing fuscous. Male genitalia: Valve (fig. 23); aedeagus spiculate apically, without cornuti. Female genitalia: (fig. 24) Ostium bursae large, subdorsally infolded, dorso-ventrally flattened; ductus bursae membranous, slightly strigate, less than one-half as wide as ostium bursae, looping dorsad before entering corpus bursae; corpus bursae with large cephalic portion bent laterad, caudal portion narrower to apex; ductus seminalis arising from apex of corpus bursae. Flight period: June to early September.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 absent on first abdominal segment, meso- and metathorax; second abdominal segment with pinacula of SV-1 and SV-2 separated, SV-1 about equidistant from SV-2 as V-1 setae are from each other; mesothorax with D-2 closer to D-1 than to SD-2; crochets 17-20; integument without microspines; mandible with subterminal processes on ribs 2, 3; raduloid with 12 ridges. mandible with subterminal processes on ribs 2, 3; raduloid with 12 ridges.

Distribution: Nova Scotia to British Columbia; in East, south to Pennsylvania; in west, south to Colorado and California; (California, no specific records).

Host plants: Aster sp. (aster); *Mentha arvensis* (wild mint); *Spiraea salicifolia.*

COMMENTS

Although this species has been reported from California (Crumb, 1956), I was unable to verify this locality data. The range of *P. aeroides* is essentially Nearctic Boreal. This is one of the few California plusiines lacking a silver stigma on the forewings.

POLYCHRYSIA HUBNER 1821:251

POLYCHRISIA MORIGERA (EDWARDS)
(Figs. 25, 26, 69)

Deva morigera Edwards 1886:169.

Adult: Forewing length 15-17 mm. Ground color dark brown, light brown in large, diffuse area including anterior one-half of pm. line, extending to reniform and outward to st. line, light brown outside st. line near anal angle and inside pm. line, light brown below stigma, also light brown from between arms of stigma to costa and inward from am. line to b.l., except for small teardrop-shaped dark brown spot on inward side of

orbicular, above stigma; am. line oblique, silver, arching at fusion with inside arm of stigma; stigma tapering from anterior base to near mid-point, then angled outward, tapering to elongate sharp point, reaching pm. line; outside arm of stigma fusing with outside margin of orbicular, forming small, sharp outward tooth at top of orbicular, then curving back to costa; reniform nearly obscure; pm. line with short perpendicular section at costa, sharply arched outward to point, incurved to CU_1, small incurve to point of stigma, another deeper incurved arch to 2A; t.l. smoothly following outer margin, conspicuous; all lines silvered, except where black covers medial section of st. line. Hind wing dark fuscous with pale median band, fringe white. Labial palpus relatively long, third segment elongate, upcurved, extending well beyond vertex of head, evenly tufted ventrad. Male genitalia: Capsule small; valve (fig. 25); juxta with pointed apex; aedeagus spinose apically; apical cornutus slender. Female genitalia: (fig. 26) Ostium bursae membranous; ductus bursae with caudal one-third membranous, middle portion abruptly expanded dorsally to about three times width of caudal section, sclerotized, doubling in width in third section, strigate to corpus bursae; corpus bursae broad toward apex with bluntly pointed fundus; ductus seminalis arising from apex of corpus bursae. Flight period: May and June.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 absent on first abdominal segment, meso- and metathorax; pinacula of SV-1 and SV-2 partially fused on second abdominal segment; on abdominal segment 4, V-1 closer to SV-2 than V-1 setae are to each other; on mesothorax D-2 equidistant from D-1 and SD-2; crochets 21-23; minute integumental microspines present; head setae with black annuli at base; rib 2 of mandible with subterminal process; raduloid absent.

Distribution: Montana, Wyoming, Colorado, Oregon and California; (California, no specific localities).

Host plant: Delphinium sp. (larkspur).

COMMENTS

A Western Boreal species, *P. morigera* should be found in mountainous areas of Northern California, perhaps diurnally in late spring and early summer.

AVEDA McDUNNOUGH 1944:213

ADEVA ALBAVITTA (OTTOLENGUI)
(Figs. 27, 28, 70; Map 8)

Autographa albavitta Ottolengui 1902:75.
Behrensia hutsonii Smith 1904:60.

Adult: Forewing length 12-14 mm. Ground color light gray, lightest at base to am. line, on outer margin from st. line, dark gray medially between am. and pm. lines from costa to anal margin, shaded dark gray between pm. and st. lines; pair of brown-black, strongly contrasting patches from

st. line to fringe, between M_2 and CU_1, divided by white scaling on M_3; small black dots at anal margin inside am. line and outside pm. line; am. line with prominent inward tooth behind cell, with black margin outside; pm. and st. lines sinuous, not dentate, white; all spots well-developed, outlined with pale yellow, some black highlights inside; orbicular subtriangular; suborbicular irregularly ovate, subequal to orbicular, no silver stigma; reniform oblong, indented on outer side. Hind wing weakly fuscous on outer margin and toward base, a pale gray to white band between; wing fringes white with fuscous bands. Male genitalia: Small, capsule compact; valve (fig. 27); uncus thick, with apical spine, tegumen short, broad; juxta strongly pointed; vinculum short, pointed; aedeagus longer than valve, short basal cornutus on circular base. Female genitalia: (fig. 28) Ostium bursae undifferentiated; ductus bursae narrow caudad, widening to about 4 times caudal width, becoming strigate to corpus bursae; corpus bursae narrowed elongate on cephalic one-half; ductus seminalis arising from apex of corpus bursae. Flight period: April (desert form, *A. a. hutsonii*); late May and June (mountain form, *A. a. albavitta*).

Larva: Unknown.

Distribution: Nevada, Arizona and California.

Host plant: Unknown.

COMMENTS

The preceding description applies to *A. a. hutsonii,* the typical form is darker and more contrasting throughout. This is one of the few plusiine species which occurs both in the mountains and desert.

PSEUDEVA HAMPSON 1913:447

PSEUDEVA PALLIGERA (GROTE)
(Figs. 29, 30, 71; Map 7)

Deva palligera Grote 1881:35.

Adult: Forewing length 15-17 mm., concave on outer margin below apex. Ground color yellow or straw-yellow, some pale pink in costa area and outside pm. line; all lines single; am. line slightly sinuous; pm. line sharply inturned to costa, straight oblique to CU_1, tl then turned slightly vertically to anal margin, outlined pale on outer side; st. line represented by weak fuscous shading; orbicular relatively large, somewhat ovate; smaller suborbicular often visible, lacking silvered stigma; reniform visible; all spots thinly lined fuscous. Hing wing straw-yellow or pale yellow. Male genitalia: Genital capsule small; valve (fig. 29); vinculum short, pointed, juxta without spine or apical point; aedeagus with small median cornutus, sclerotized, curved spinose plate apically. Female genitalia (fig. 30): Ostium bursae membranous, protected by folds of eighth abdominal segment; ductus bursae strigate, granulose; corpus bursae granulose, with pointed lobe latero-caudad; ductus seminalis arising from granulose apex

of corpus bursae. Flight period: May to mid-July on coast and in south; July to August in Sierra Nevada.

Larva: Unknown.

Distribution: California; and scattered records from Montana, Idaho, and Colorado.

Host plant: Thalictrum sp. (meadow-rue).

COMMENTS

Though little is known of its biology, California collections contain good series of adult specimens, indicating that *P. palligera* is not a particularly rare species in the State. This species has essentially a Western Boreal range. Like *Plusia aeroides*, this species has pale forewings and lacks the typical silvered stigma.

AUTOGRAPHA HUBNER (1821:251)

A KEY TO ADULT CALIFORNIA *AUTOGRAPHA*

1. Forewing stigma and spot united to form large bilobed silver mark extending from am. line to pm. line . . . . . *biloba*
   Forewing silver mark not as described above 2
2. Forewing am. line and pm. line relatively straight, subparallel . . . . . *pasiphaeia*
   Forewing am. and pm. lines otherwise 3
3. Forewing am. and pm. lines smoothly curved and diverging; stigma broadly U-shaped, usually with accompanying spot reduced or absent; wings mostly unmottled, gray with dark brown medio-posteriorly between am. and pm. lines . . . . . *ampla*
   Forewing not as described above 4
4. Forewing ground color gray, mottled, may appear brown if faded; black apical dash (ap. d.) extending from subterminal line (st.) nearly to pm. line . . . . . *californica*
   Forewing ground color brown, without well-defined ap. d. 5
5. Forewing am. line smooth, straight, or very slightly curved . . . . . *pseudogamma*
   Forewing am. line strongly bowed outward 6
6. Forewing pm. line forms a strong tooth just opposite silver spot and another usually smaller tooth below the first; often much of wing with purple tint; northwestern corner of State . . . . . *corusca*
   Forewing pm. line not toothed, slightly sinuous, lacking purple tint: (distribution elsewhere) 7
7. Forewing silver stigma-spot solid, with little or no constriction at middle; st. line weak, sinuous, covered by fuscous band . . *metallica*
   Forewing stigma and spot separated, or if fused, narrowly constricted at juncture; st. line strong, jagged . . . . . *labrosa*

AUTOGRAPHA BILOBA (STEPHENS)

(Figs. 31, 32, 72; Map 9)

Plusia biloba Stephens 1832:104.

Adult: Forewing length 17-22 mm. Ground color brown, basal and apical areas paler, darker wedge-shaped streak to apical angle, small dark streak at middle of outer margin; am. line excurved medially, silvered; pm. line slightly sinuous, some silvering posteriorly; reniform severely constricted at middle, lower portion partially silvered, C-shaped facing downward; stigma large, bottom edge nearly parallel with edge of wing, deeply indented medially on upper portion, silver. Hind wing light fuscous, paler between veins toward base. Male genitalia: Valve (fig. 31); aedeagus without cornutus; length of tegumen greater than one-half length of valve. Female genitalia: (fig. 32) Ostium small, weakly sclerotized and strigate; ductus bursae weakly sclerotized, strigate, relatively short and straight; corpus bursae narrow, slightly tapered to membranous but strigate fundus; ductus seminalis arising from apex of corpus bursae. Flight period: multivoltine, adults flying all year.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 absent on first abdominal segment, meso- and metathorax; pinacula of SV-1 and SV-2 partially fused on abdominal segments 2-4; V-1 setae closer to each other than V-1 is to SV-2 on fourth abdominal segment; crochets 20-22; integumental microspines relatively long, often dark, mandible without subterminal processes on ribs 2, 3; raduloid with 13 ridges; head with black, lateral stripe including all ocelli.

Distribution: Nova Scotia to Manitoba; United States.

Host plants: Brassica oleracea varieties; *Centaurea solstitialis* (cornflower); *Cirsium horridulum* (thistle); *Delphinium* sp. (larkspur); *Geranium* sp. (geranium); *Gladiolus* sp. (gladiola); *Hedra* sp. (ivy); *Helianthus* sp. (sunflower); *Helxine soleirolii* (baby's tears); *Hordeum vulgare* (barley); *Lactuca sativa* (lettuce); *Medicago sativa* (alfalfa); *Mimulus cardinalis* (scarlet monkey flower); *Musa paradisiaca* (plantain); *Nicotiana tobaccum* (tobacco); *Phacelia* sp.; *Phaseolus vulgaris* (kidney beans); *Salvia leucophylla* (coastal sage scrub); *Stachys ajugoides; Trifolium incarnatum* (crimson clover); *Verbena* sp. (verbena).

COMMENTS

This is a species well adapted to living in California, particularly in the disturbed areas of the San Francisco Bay region, south along the coast and throughout the Central Valley. It is evidently capable of continuous generations under the proper conditions. I have records of *A. biloba* from Alameda County of specimens taken in nearly every month of the year.

AUTOGRAPHA CALIFORNICA (SPEYER)

Alfalfa Looper

(Figs. 1, 2, 33, 34, 73, 87; Map 2)

Plusia gamma ab. *californica* Speyer 1875:164.

Adult: Forewing length 17-20 mm. Ground color shades of gray, mottled, tending toward light brown in some individuals; light gray patch covering upper one-half of pm. line, widening to costa, smaller patch at anal angle; oblique pale gray band above stigma to costa, including oblong orbicular; reniform constricted on outer side, thinly silvered, outlined with black; am. line excurved medially; pm. line minutely lobed throughout, toothed posteriorly; st. line jagged, with characteristic black dash inward between R_5 and M_1, extending to near pm. line. Male genitalia: Valve (fig. 33); tegumen about one-half length of valve; aedeagus with basal cornutus one-fifth length of aedeagus. Female genitalia: (fig. 34) Ostium bursae short; ductus bursae short, membranous, becoming sclerotized and strigate to corpus bursae; corpus bursae straight, strigate area constricted around middle; apex narrowed, blunt; ductus seminalis arising from apex of corpus bursae. Flight period: multivotine, adults flying all year.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 absent on first abdominal segment, meso- and metathorax; pinacula of SV-1 and SV-2 partially fused on abdominal segments 2–4; V-1 setae closer to each other than V-1 is to SV-2 on fourth abdominal segment; crochets 18-20; integument with minute granules, lacking microspines; mandible without subterminal processes on ribs 2, 3; raduloid ridges 12; head with or without black, lateral stripe.

Distribution: Alberta and British Columbia; western United States, including Kansas and Nebraska; California.

Host plants: Polyphagous. *Allium cepa* (onion); *Amelanchier florida* (Pacific service berry); *Amsinckia douglasiana* (Douglas fiddleneck); *Apium graveolens* (celery); *Atriplex* sp. (saltbush); *Beta vulgaris* (beets); *Brassica oleracea* varieties; *B. rapa* (turnip); *Calendula officinalis* (pot marigold); *Carthamus tinctorius* (safflower); *Castilleja* sp. (paint brush); *Citrus sinensis* (sweet orange); *Erechtites arguta* (tooth coast fireweed); *Fragaria* sp. (strawberry); *Gossypium* sp. (cotton); *Hordeum vulgare* (barley); *Lactuca sativa* (lettuce); *Lupinus* sp. (lupine); *Lycopersicon esculentum* (tomato); *Nemophila menzeisii* (baby blue eyes); *Phaseolus* sp. (beans); *Podocarpus* sp.; *Raphanus sativus* (radish); *Rheum* sp. (rhubarb); *Senecio cineraria* (dusty miller); *S. jacobaea* (tansy ragwort); *Solanum tuberosum* (potato); *Spinacea oleracea* (spinach); *Triticum aestivum* (wheat); *Vitis* sp. (grape).

COMMENTS

Like *A. biloba*, this species is well suited for living with man. But *A. californica* is apparently more established in less disturbed areas of the State than the former. Both species may be found flying somewhere in the State all year around.

AUTOGRAPHA PSEUDOGAMMA (GROTE)
(Figs. 35, 36, 74; Map 5)

Plusia pseudogamma Grote 1875b:203

Adult: Forewing length 17–20 mm. Ground color dark brown, large pale area between reniform and st. line, extending from costa to middle of pm. line; pale near anal angle from st. line to fringe; terminal line (t.l.) pale; am. line oblique, nearly straight, pale; pm. line with long, gentle curves, untoothed or minutely toothed opposite stigma, pale; st. line sinuous, not angular or dentate, conspicuous, dark shading on inward side, lacking distinct black dashes (as in *A. californica*); stigma somewhat V-shaped, silvered, with obovate silver spot attached, rarely separated; orbicular kidney-shaped; reniform conspicuous, strongly indented at middle on outer side, thinly silvered, some black outward. Hind wing dull luteus, becoming fuscous outward. Male genitalia: Similar to *A. californica;* valve; (fig. 35); tegumen about one-half length of valve; aedeagus with basal cornutus, approximately one-seventh length of aedeagus (aedeagus of *A. californica* about one-fifth). Female genitalia (fig. 36) Ostium bursae short; ductus bursae elongate, slender, heavily strigate, with short appendage caudad; corpus bursae elongate, not constricted at middle, somewhat pointed cephalad, no thickened area or protuberance near entrance of ductus bursae; ductus seminalis arising from somewhat truncate apex of corpus bursae. Flight period: June to August.

Larva: Unknown.

Distribution: Scattered records from Nova Scotia to British Columbia and north to Alaska; south into states bordering Canada; south in Rocky Mountains to Arizona; and south in western ranges to California.

Host plant: Unknown.

COMMENTS

Superficially, this species resembles a brown color phase of *A. californica.* They can be differentiated externally by the presence of a black apical dash projecting from st. line nearly to pm. line on *A. californica,* while specimens of *A. pseudogamma* lack the apical dash. *Autographa pseudogamma* is a Nearctic Boreal species, with a wide North American distribution, but collection records are quite sporadic and relatively few in number.

AUTOGRAPHA PASIPHAEA (GROTE)
(Figs. 37, 38, 75; Map 3)

Plusia pasiphaea Grote 1873:146.

Adult: Forewing length 13–17 mm. Ground color light brown, dark brown between am. and pm. lines below cell; darker shading beyond pm. line partially obscuring st. line, this area somewhat peppered; am. line pale, oblique, nearly straight; pm. line pale, very slightly sinuous, except where

back-curved to costa; orbicular obovate, pale in outline; reniform very weak; stigma silver, Y-shaped, stem directed outward, occasionally abbreviated, no separate silver spot. Hind wing ochreous, becoming fuscous on outer one-third. Male genitalia: Valve (fig. 37); costa of valve straight; tegumen about one-half length of valve; aedeagus with basal cornutus approximately one-fourth length of aedeagus. Female genitalia (fig. 38) Ostium bursae short; ductus bursae strigate, sclerotized; corpus bursae with semilunate heavily pigmented protuberance near entrance of ductus bursae, apex slightly tapered and rounded; ductus seminalis arising from apex of corpus bursae. Flight period: April to October, records in January to March on the coast and in southern counties.

Larva: Unknown.

Distribution: California endemic.

Host plants: Stachys ajugoides, S. rigida.

COMMENTS

A species endemic to California and widely distributed throughout the State. The immature stages are as yet undescribed, even though the host plants are known and the adults are fairly common during most of the year in some areas.

AUTOGRAPHA METALLICA (GROTE)

(Figs. 39, 40, 76; Map 4)

Plusia metallica Grote, 1875a:311.

Adult: Forewing length 18–20 mm. Ground color light brown, darker orange-brown between am. and pm. lines below cell; darker diagonal band from wing apex, becoming diffused posteriorly; lines weak; am. line gently curved; pm. line smoothly gently curved inward from costa to near stigma on CU_2 then abruptly directed outward, then vertically to posterior margin of wing; stigma usually one spot, oblique, parallel sided, swollen and broadly rounded on lower portion. Hind wing dull luteous, becoming dull fuscous outwardly. Male genitalia: Similar to *A. californica* and *A. pseudogamma;* valve (fig. 39); tegumen approximately one-half length of valve; aedeagus with basal cornutus, approximately one-sixth length of aedeagus (larger than cornutus of *A. pseudogamma* and smaller than *A. californica*). Female genitalia (fig. 40): Ostium short; ductus bursae elongate, rope-like, strigate with short appendage caudad; corpus bursae mostly circular, with elongate, narrow apex curved and appressed to corpus bursae laterad; corpus bursae without thickened area or protuberance near entrance of ductus bursae; ductus seminalis arising from apex of corpus bursae. Flight period: late June to August.

Larva: Unknown.

Distribution: Alberta and British Columbia; northwestern United States to California.

Host plant: Unknown.

COMMENTS

This species has a rather restricted Western Boreal range. In California most records are from the Sierra Nevada, but I have seen three specimens taken in June from Point Reyes Peninsula, Marin County. There is much to be learned about the biology and distribution of *A. metallica.*

AUTOGRAPHA CORUSCA (STRECKER)

(Figs. 41, 42, 77; Map 8)

Plusia corusca Strecker 1885:178.

Adult: Forewing length 15–18 mm. Ground color chocolate-brown, purple tint basad to am. line, along costal margin, on outside of pm. line and outside st. line opposite two deepest infoldings; am. line strongly bowed outward; pm. line sinuous, minutely dentate; both lines thinly silvered, variously outlined with black; st. line prominent, white, lined with black inside anteriorly; orbicular small, nearly circular; reniform conspicuous, constricted medially, both spots thinly silvered and outlined with black; stigma a rounded silver spot with two short arms anteriorly; accompanying silver spot usually teardrop-shaped, directed outward, parallel to posterior edge of wing, usually attached by narrow end, occasionally separated. Hind wing dull luteous, outer one-third fuscous. Male genitalia: Valve (fig. 41); tegumen greater than one-half length of valve; aedeagus with one basal cornutus approximately one-fifth length of aedeagus. Female genitalia: (fig. 42) Ostium bursae dorso-laterally infolded, strigate and sclerotized, ventro-caudal portion expanded; ductus bursae elongate, mostly strigate and sclerotized, with short dorso-caudal projection, U-shaped prior to entering corpus bursae; corpus bursae laterally compressed, strigate on caudal one-half, tapering to narrowly rounded apex, with thickened, rounded protuberance just cephalad of entrance of ductus bursae; ductus seminalis arising from apex of corpus bursae. Flight period: June to October.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 present on first abdominal segment; SV-2 absent on meso- and metathorax; mandible lacking subterminal processes on ribs 2, 3; raduloid ridges 13.

Distribution: Alaska, south to California and Colorado.

Host plant: Alnus sp. (alder); *Salvia leucophylla* (coastal sage scrub).

COMMENTS

Larval description is based upon a single exuvium in the collection of the National Museum of Natural HIstory. This is apparently the same specimen utilized by Crumb (1956) to describe the larva of *A. corusca.* More material is necessary to confirm this larval-adult association and to provide a more detailed larval description. This species has coastal distribution in California, but is of the Western Boreal type elsewhere in its range. The ability of this species to transfer from alder in the mountainous portions of its range to coastal sage scrub in coastal California may explain this apparent discrepancy.

AUTOGRAPHA LABROSA (GROTE)

(Figs. 43, 44. 78; Map 4)

Plusia labrosa Grote 1874:207.

Adult: Forewing length 16–18 mm. Ground color deep reddish-brown, pale brown basad to am. line, along costal margin, narrowly on outside of pm. line and outside st. line at first sharp indentation and at posterior portion of outer wing margin; am. line strongly bowed outward; pm. line very slightly sinuous, not toothed (as in *A. corusca*), both lines somewhat silvered posteriorly; st. line prominent, lined on inner side by broad, dark reddish-brown bands; orbicular small, somewhat oblong, reniform constricted medially; stigma rounded spot with two short arms upward, silver (as *A. corusca*); accompanying silver spot teardrop-shaped, directed outward parallel to posterior edge of wing, usually attached by narrow end but occasionally separated from stigma. Hind wing dull luteus, outer one-third fuscous. Male genitalia: Similar to *A. corusca;* valve (fig. 43); tegumen greater than one-half length of valve; aedeagus with one basal cornutus, approximately one-fifth length of aedeagus. Female genitalia: (fig. 44)) Similar to *A. corusca;* ostium bursae dorso-laterally infolded, strigate and sclerotized, ventro-caudal portion expanded; ductus bursae elongate, mostly strigate and sclerotized with short dorso-caudal projection, U-shaped prior to entering corpus bursae; corpus bursae laterally compressed, not strigate on caudal one-half (as in *A. corusca*), apex not as narrow; thickened protuberance cephalad of entrance of ductus bursae not as pronounced as in *A. corusca;* ductus seminalis arising from apex of corpus bursae. Flight period: late May to mid-October (with one reared specimen emerging at the end of March in San Francisco).

Larva: Unknown.

Distribution: Endemic to California's central coast.

Host plant: Scrophularia californica (figwort).

COMMENTS

One of three species of Plusiinae endemic to California (with *A. phasiphaea* and *Autoplusia olivacea*). Genitalic morphology and wing patterns indicate *A. labrosa* and *A. corusca* are very closely related. Both species occur in Marin, Sonoma and Mendocino counties, but apparently have very different hose plant associations. The immature stages should prove to be similar as well.

AUTOGRAPHA AMPLA (WALKER)

(Figs. 45, 46, 79; Map 6)

Plusia ampla Walker 1857:910.

Adult: Forewing length 19–21 mm. Ground color gray; chocolate-brown below stigma, between am. and pm. lines, contrasting

with ground color; small black spot at wing apex; reniform with some black outlining; pinkish am. and pm. lines black lined where they contact dark-brown median area; short black streaks on costa above reniform and orbicular; st. line obscure except for short black portion to costa; stigma broadly U-shaped, thinly silvered, occasionally with short silver line extending from bottom outward, occasionally with separate, minute silver dot. Hind wing light fuscous with darker shadings. Male genitalia: Valve (fig. 45); length of tegumen greater than one-half length of valve; cornutus approximately one-fourth length of aedeagus. Female genitalia: (fig. 46) Ostium cup-shaped, smoothly sclerotized, infolded subdorsally; ductus bursae slender, initially membranous then sclerotized, strigate, with short projection caudad; corpus bursae with thickened, pigmented round protuberance dorsad, cephalad of entrance of ductus bursae; apex of corpus bursae broadly rounded; ductus seminalis arising from apex of corpus bursae. Flight period: June to August.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 present on first abdominal segment; SV-2 absent on meso- and metathorax; pinacula of SV-1 and SV-2 partially fused on abdominal segments 2–4; abdominal segment 4 with V-1 setae closer to each other than V-1 is to SV-2; crochets 24-28; without conspicuous integumental microspines; mandible with subterminal processes on ribs 2, 3; raduloid ridges 18.

Distribution: Nova Scotia to British Columbia; south to North Carolina in East and to Arizona and California in West.

Host plants: Alnus oregona (red alder); *Alnus* sp. (alder); *Amelanchier florida* (Pacific service berry); *Betula pendula* (European white birch); *Populus balsamifera* (balsam poplar); *P. tremuloides* (American aspen); *Prunus* sp.; *Salix* sp. (willow); *Shepherdia canadensis; Viburnum cassinoides* (withe-rod).

COMMENTS

This species has a Nearctic Boreal range. In the Coast Range it extends further south than is known for other plusiines with this type of distribution. Unlike many of the Boreal species which feed on conifers, *A. ampla* feeds on deciduous, broadleaf trees and shrubs. The larval setal pattern indicates that *A. ampla* is either closely allied to some of the conifer feeding *Syngrapha* species or that these characters are convergent. Since the feeding habits are dissimilar, a close phylogenetic relationship seems to be the logical explanation.

SYNGRAPHA HUBNER 1821:250

KEY TO ADULT *SYNGRAPHA*

1. Hind wings yellow, narrowly bordered with fuscous . . . . . *alticola*
   Hind wings dull luteus, broadly and somewhat diffusely bordered fuscous 2
2. Forewings with stigma and accompanying spot mostly silver; wing length usually 14–16 mm. . . . . *alias*
   Forewings with stigma and accompanying spot mostly gold; wing length usually 17–20 mm. . . . . *celsa*

SYNGRAPHA ALIAS (OTTOLENGUI)
(Figs. 47, 48, 80; Map 11)

Autographa alias Ottolengui 1902:69.

Adult: Forewing length 15–17 mm. Ground color variously dark-gray, lightest on costal margin basad of am. line, which may be dusted with silver, and from st. line outward, darkest below stigma and between am. and pm. lines; am. and pm. lines somewhat silvered, outlined black; reniform thinly outlined silver; st. line well-defined, jagged, black; stigma irregular, thickly silvered, lower side with two knobbed extensions, the outer often separated as distinct silver dot. Hind wing pale luteous, diffused fuscous at base and broadly fuscous on outer one-third. Male genitalia: Valve (fig. 47); aedeagus with basally broad apical cornutus, sharply curved, tapered to point; vesica of aedeagus granulate basad. Female genitalia: (fig. 48) Ostium bursae complex, caudal portion short, wide, slightly wider than long, strigate, anterior portion somewhat longer, narrower, rounded basad, produced laterally as short rounded appendage; ductus bursae sclerotized, strigate toward entrance into corpus bursae; corpus bursae membranous, apex shagreened; ductus seminalis arising from apex of corpus bursae. Flight period: late July to early August.

Larva: Refer to the description of *S. celsa.* Of the characters used in this study, none were found which would permit the differentiation of larvae of *S. alias* from *S. celsa.* Ross and Evans (1957) described briefly the superficial appearance of the two species in the following manner: *"P. alias* ... addorsal, subdorsal, and spiracular stripes white, the subdorsal wider than the addorsal." For the second species they wrote, *"P. celsa* ... addorsal, subdorsal, and spiracular stripes white, the addorsal broader than the subdorsal although it may appear subequal; fairly prominent black pinacula."

Distribution: Newfoundland to Alaska; in East, south to New York and Wisconsin; in West, south in Rocky Mountains to Arizona and in western mountain ranges to California.

Host plants: Abies amabilis (amabilis or lovely fir); *A. balsamea* (balsam fir); *A. lasiocarpa* (alpine fir); *Larix laricina* (tamarack); *Picea mariana* (black spruce); *P. rubens* (red spruce); *Pinus banksiana* (jack pine); *P. monticola* (western white pine); *Pseudotsuga menziesii* (Douglas fir); *Thuja plicata* (giant cedar); *Tsuga heterophylla* (western hemlock).

COMMENTS

This species has a Nearctic Boreal range. In the western portion of its range it is sympatric, for the most part, with *S. celsa,* but is currently known only from the northwestern corner of California. The fact that it has not been shown to share more of the range of *S. celsa* in this State may be an artifact of poor collecting for Plusiinae in the coniferous forests. If this is the case, more thorough collecting, perhaps diurnally, may turn up additional species of *Syngrapha* not presently known from California.

SYNGRAPHA CELSA SIERRAE (OTTOLENGUI)
(Figs. 3, 49, 50, 81; Map 11)

Plusia celsa Hy. Edwards 1881:101 (in part).
Autographa celsa race *sierrae* Ottolengui 1919:123.

Adult: Forewing length 17–19 mm. Ground color pale gray, darker between am. and pm. lines, in diffuse band between pm. and st. lines, somewhat overlapping st. line to wing apex; all lines strong, doubled; am. line strongly incurved opposite orbicular, toothed on 2A; st. line clear, black, lined with white outside, dentate, usually without inward projecting black dashes; outer margin with alternating light and dark bands; orbicular usually subtriangular, pale gray, black outlined; reniform clearly visible; stigma somewhat V-shaped, pale gray, outlined pale gold, accompanying rounded, gold spot usually attached on outer margin adjacent to apex of stigma. Hind wing fuscous on outer one-third, pale luteous on inner two-thirds. Male genitalia: Valve (fig. 49); vinculum short, pointed; juxta with weak apical point; aedeagus heavily spiculate apically, with large apical cornutus and smaller basal cornutus. Female genitalia: (fig. 50) Ostium bursae large, nearly as long as ductus bursae, strongly sclerotized, membranous finger-like process from juncture with ductus bursae projecting caudad; ductus bursae broad, sclerotized, strigate; corpus bursae with well-defined, darkened apex; ductus seminalis arising from dorsum or broadly rounded apex of corpus bursae. Flight period: late July to early September.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 present on first abdominal segment, meso- and metathorax; mesothorax with D-2 equidistant from D-1 and SD-2; crochets 25-28; pinacula and setal bases dark; integumental microspines present, often dark and concentrated into middorsal and subdorsal longitudinal bands; mandibles lacking subterminal processes on ribs 2, 3; raduloid absent.

Distribution: Alaska, south to California and Utah (*S. celsa*); California (*S. c. sierrae*).

Host plants: Abies grandis (giant fir); *A. lasiocarpa* (alpine fir); *Picea engelmanii* (Engelmann spruce); *P. glauca* (white spruce); *Pinus monticola* (western white pine); *Tsuga heterophylla* (western hemlock).

COMMENTS

The distribution of this species corresponds to the Western Boreal range used by Powell (1964). In California the range of *S. c. sierrae* encompasses the coniferous forests of the northern and coastal mountain ranges and Sierra Nevada. This subspecies differs from the nominate subspecies by the variable pale gray color on the forewings. Some specimens are gray-white in certain areas of the northwestern corner of the State. The subspecies also differ in the shape and form of the stigma and accompanying spot; the latter most often attached, but separated and smaller in the nominate subspecies. Although the adults may fly as early as May and as late as September, the population peaks between the last two weeks of July and the first two weeks of August in California.

SYNGRAPHA ALTICOLA (WALKER)
(Figs. 51, 52, 82; Map 11)

Plusia alticola Walker 1857:912.

Adults: Forewing length 12–14 mm. Ground color brown; chocolate-brown below stigma, between am. and pm. lines; dark brown above stigma, between orbicular and reniform; shaded between pm. and st. lines; light brown outward from reniform to pm. line and outward from st. line; gray powdered basally to am. line; pm. line smoothly, broadly arched, directed strongly basad at costa; st. line black, distinct; stigma short, stout, silver except at base. Hind wing bright yellow, narrowly fuscous margined. Underside mostly pale yellow. Male genitalia: Valve (fig. 51); juxta with well-developed, sharp apical spine, aedeagus without cornuti. Female genitalia: (fig. 52) Ostium bursae broad, nearly cylindrical, thick, rounded pouch-like structures on each side; ductus bursae mostly membranous, approximately one-half width ostium bursae, somewhat granular; corpus bursae somewhat J-shaped from ventral aspect, tapered to rounded point on ends; ductus seminalis arising from granulate apex of corpus bursae. Flight period: mostly July.

Larva: Unknown.

Distribution: Scattered records from Manitoba west to Alaska and British Columbia; south to Montana, Wyoming and Colorado, with isolated records in Sierra Nevadas of California.

Host plants: Unknown.

COMMENTS

This species has a strictly Boreal range, occurring at high altitudes and/or high latitudes. In California it can be found at the highest alpine meadows of the Sierra Nevada. Collection records are spotty throughout its apparent range. I was not aware that *C. alticola* extended west of the Rocky Mountains until Mr. David Bauer of South Lake Tahoe, brought to my attention a series he had taken day collecting in mid-July at 10,500 feet in Sonora Pass, Mono County, California. Many of the wide gaps in the distribution of the species can be filled if collectors will look for them flying in daylight at high elevations.

ANAGRAPHA McDUNNOUGH

ANAGRAPHA FALCIFERA (KIRBY)
Celery Looper
(Figs. 53, 54, 83; Map 12)

Plusia falcifera Kirby 1837:308.

Adult: Forewing length 17–19 mm; brown, darkest below stigma, between am. line, diffusing outward to anal angle; narrow dark-brown band, slightly curving from apical angle to near midpoint on st. line; palest

areas between am. line and wing base to costa and from st. line outward; am. line silver, oblique, smoothly curving from base of stigma to anal margin, other lines obscure; stigma long, thick, slighly curved, rounded apically, no separate silver spot. Hind wing pale luteous, fairly broad somewhat diffuse outer fuscous band, diffuslly fuscous at base, usually strong fuscous pm. band. Male genitalia: Valve (fig. 53); aedeagus with sharply pointed, basal cornutus. Female genitalia: (fig. 54) Ostium bursae short, narrow, ductus bursae thick, strigate, sclerotized; apical region of corpus bursae sclerotized, darkly pigmented, spiculate; ductus seminalis arising from anterior portion of apex. Flight period: multivoltine, adults flying all year in warm regions.

Larva: No vestige of prolegs on abdominal segments 3 and 4; SV-2 present on first abdominal segment, absent on meso- and metathorax; D_2 closer to D_1 than to SD-2; on mesothorax interval between V-1 setae on abdominal segment 4 one-half the interval between V-1 and SV-2; crochets 21-24; integumental microspines present, inconspicuous; mandible lacking processes on ribs 2, 3; raduloid absent; head without dark pigmentation.

Distribution: Nova Scotia to British Columbia; United States.

Host plants: Apium graveolens (celery); *Beta vulgaris* (beets); *Brassica oleracea* varieties; *Daucus carota* (carrot); *Lactuca sativa* (lettuce); *Phaseolus* sp. (beans); *Plantago* sp. (plantain); *Urtica lyalli* (lyall nettle); *Vaccinium macrocarpon* (American cranberry); *Viburnum* sp.; *Zea mays* (corn).

COMMENTS

As with *Pseudoplusia includens,* the few collection sites shown on the map do not depict a highly successful, very adaptable, polyphagous species, which *A. falcifera* is known to be in other portions of its vast range. More sampling in disturbed areas should expand its known California distribution. In certain portions of its range, *A. falcifera* has a pale gray, early spring brood and one or more brown, summer broods.

CALOPLUSIA SMITH 1891:52

CALOPLUSIA IGNEA (GROTE)
(Figs. 4, 55, 56, 84; Map 12)

Plusia ignea Grote 1863:274.

Adult: Forewing length 14-16 mm. Forewing like that of *Syngrapha alticola* but differing as follows: less mottled; am. line smoothly curved; pm. line only slightly curved to costa, both lines often slightly silvered; st. line weak, somewhat obscured by diffuse dark-brown band; stigma more elongate, slender, extending almost to pm. line. Hind wing yellow, fuscous margin slightly wider than *S. alticola.* Underside mostly pale yellow. Male genitalia: Valve (fig. 55); juxta with large apical spine; aedeagus basally with small, spinose plate, apically with larger rounded plate bearing small cornuti. Female genitalia: (fig. 56) Ostium bursae large, length twice

width, sclerotized, somewhat strigate; ductus bursae strigate near corpus bursae; corpus bursae with apex thickened, caudo-ventral edge heavily pigmented; ductus seminalis arising from apex of corpus bursae. Flight period: late June through August.

Larva: Unknown.

Distribution: Newfoundland to Alaska; south to California and Colorado.

Host plants: Unknown.

COMMENTS

A very similar palearctic species, *C. hochenwarthi* (Hochenwarth), is known to feed on species of Apiaceae (Umbelliferae). Plants of this family may also serve as hosts for the Nearctic species, *C. ignea.* Distribution of this species is strictly Nearctic Boreal, occurring sympatrically in much of its range with *S. alticola* at the higher elevations and latitudes. Both species are diurnal, an adaptation to the inability to fly at low nighttime temperatures typical in this habitat.

CHRYSASPIDIA HUBNER 1821:252

CHRISASPIDIA PUTNAMI (GROTE)
(Figs. 57, 58, 85; Map 12)

Plusia putnami Grote 1873:146.

Adult: Forewing length 14–17 mm. Ground color yellow-brown, with metallic yellow-gold below stigma to anal margin, on costal margin at base, and obliquely from wing apex to near M_2, outlined outward with dark brown, some silvering on lower portion near M_2; all lines dark brown, visible on posterior one-half of wing; am. and pm. lines double; am., m.l. and pm. oblique, parallel; st. line thinly dark brown, wavy; t.l. smoothly following outer wing margin; fringes pinkish; stigma large silver spot, subtriangular, corners rounded, often extending anteriorly into cell with accompanying silver teardrop-shaped spot about one-half as high, most often detached but occasionally fused to stigma; orbicular obscure; reniform small black dot. Hind wing fuscous. Male genitalia: Valve (fig. 57); tegumen less than one-half as long as valve; vinculum long, bluntly pointed; juxta strongly produced apically; aedeagus with short, basal cornutus. Female genitalia: (fig. 58) Ostium bursae broad, dorso-ventrally compressed, sclerotized, ventro-caudal end folded cephalad, with granulose plate projecting caudad beyond ostial opening; ductus bursae enters corpus bursae at apex below, laterad of origin of ductus seminalis; corpus bursae elongate, bulbous cephalad, with signum a darkly pigmented patch. Flight period: May to September.

Larva: No vestige of prolegs on abdominal segments 3–4; SV-2 present on first abdominal segment, absent on meso- and metathorax; abdominal segments 1-4 with pinacula of SV-1 and SV-2 partially fused; on fourth

abdominal segment V-1 twice as far from SV-2 as V-1 setae are to each other; mesothorax with D-2 about equidistant from D-1 and SD-2; crochets uniordinal (unique for Plusiinae), numbering 15-25; integumental microspines present; mandible unique, ventral edge incurved forming deep pocket on mesal surface, no subterminal processes on ribs; raduloid absent.

Distribution: Nova Scotia to Alberta; in East, south to Virginia; in West, south to Colorado and California.

Host plants: Carex sp. (sedge); *Poaceae* spp. (grasses); *Sparganium* sp. (bur-reed).

COMMENTS

A closely related species, *C. nichollae* (Hampson) (1913, p. 510) has a coastal range from British Columbia to Oregon and may also occur in northwestern California. To date, no verified records of the latter species have been seen from California and therefore is not considered. For the most part, *C. putnami* has a Nearctic Boreal range. It resembles species of *Autographa* on the basis of male genitalic structures, but the larva shows a relationship to certain boreal *Syngrapha* species. Forbes (1954) reports that *C. putnami* in the Northeast is at least bivoltine.

INDEX TO HOST PLANTS

babys' tears (see *Helxine soleirollii*)
barley (see *Hordeum vulgare*)
beans (see *Phaseolus* sp.)
beans, kidney (see *Phaseolus vulgaris*)
beans, lima (see *Phaseolus limensis*)
beans, sieva (see *Phaseolus lunatus*)
beets (see *Beta vulgaris*)
Bergenia sp.
Trichoplusia ni
Beta vulgaris (beets)
Anagrapha falcifera
Autographa californica
Trichoplusia ni
Betula pendula (European white birch)
Autographa ampla
Birch, European white (see *Betula pendula*)
Brassica campestris (field mustard)
Trichoplusia ni
Brassica hirta (white mustard)
Trichoplusia ni
Brassica napus (colza)
Trichoplusia ni
Brassica nigra (black mustard)
Trichoplusia ni
Brassica oleracea varieties (broccoli, brussel sprouts, cabbage, cauliflower, kale)
Anagrapha falcifera
Autographa biloba
Autographa californica
Autoplusia egena
Pseudoplusia includens
Trichoplusia ni
Brassica rapa (turnip)
Autographa californica
Tricholplusia ni
broccoli (see *Brassica oleracea*)
brussel sprouts (see *Brassica oleracea*)
bur-reed (see *Sparganium* sp.)
cabbage (see *Brassica oleracea*)
Calendula officinalis (pot marigold)
Autographa californica
Trichoplusia ni
Carex sp. (sedge)
Chrysaspidia putnami
carnation (see *Dianthus caryophyllus*)
carrot (see *Daucus carota*)
Carthamus tinctorius (safflower)
Autographa california
Castilleja sp. (paint brush)
Autographa californica
catclaw (see *Acacia greggii*)
cauliflower (see *Brassica oleracea*)
cedar, giant (see *Thuja plicata*)
celery (see *Apium graveolens*)
Centaurea solstitialis (corn flower)
Autographa biloba
Chaenactis stevioides
Trichoplusia ni
Chaenomeles japonica, (dwarf Japanese Quince)
Trichoplusia ni
Chenopodium album (lambs-quarters)
Trichoplusia ni
Chenopodium ambrosioides
Rachiplusia ou
chinch weed (see *Pectis papposa*)
Chrysanthemum sp.
Autoplusia egena
Pseudoplusia includens
Trichoplusia ni
Chrysanthemum frutescens (Marguerite)
Autoplusia egena
Cineraria sp.
Trichoplusia ni
Cirsium horridulum (thistle)
Autographa biloba
Citrullus vulgaris (watermelon)
Trichoplusia ni
Citrus sinensis (sweet orange)
Autographa californica
Trichoplusia ni
Citrus sp.
Trichoplusia ni
clover (see *Trifolium* sp.)
clover, crimson (see *Trifolium incarnatum*)
Coleus sp. (coleus)
Pseudoplusia includens
Trichoplusia ni
coleus (see *Coleus* sp.)
colza (see *Brassica napus*)
comfrey (see *Symphytum* sp.)
Commelina sp. (day-flower)
Pseudoplusia includens
corn (see *Zea mays*)
corn flower (see *Centaurea solstitialis*)
Cosmos sp. (cosmos)
Rachiplusia ou
cosmos (see *Cosmos* sp.)
cotton (see *Gossypium* sp.)
cotton, upland (see *Gossypium hirsutum*)
cowpea (see *Vigna sinensis*)
cranberry, American (see *Vaccinium macrocarpon*)
Crepis sp. (hawksbeard)
Trichoplusia ni
Crotalaria rotundifolia
Trichoplusia ni
Croton capitatus
Pseudoplusia includens
cucumber (see *Cucumis sativus*)
Cucumis melo (melon)
Trichoplusia ni
Cucumis sativus (cucumber)
Trichoplusia ni
Cucurbita maxima (Autumn & Winter squash)
Trichoplusia ni

Cucurbita pepo (zuccini squash)
Trichoplusia ni
dandelion, common (see *Taraxacum officinale*)
Daucus carota (carrot)
Anagrapha falcifera
Autoplusia egena
Trichoplusia ni
day-flower (see *Commelina* sp.)
Delphinium sp. (larkspur)
Autographa biloba
Autoplusia egena
Polychrysia morigera
Dianthus caryophyllus (carnation)
Trichoplusia ni
dusty miller (see *Senecio cineraria*)
Erechtites arguta (tooth coast fireweed)
Autographa californica
Eregeron canadensis (horseweed)
Trichoplusia oxygramma
Erodium sp. (heronsbill)
Trichoplusia ni
Erodium cicutarium (red-stem filaree)
Trichoplusia ni
Eschscholzia californica (California poppy)
Trichoplusia ni
Eupatorium sp. (thoroughwort)
Pseudoplusia includens
Euphorbia pulcherrima (Pointsettia)
Trichoplusia ni
fiddleneck, Douglas' (see *Amsinckia douglasiana*)
figwort (see *Scrophularia california*)
filaree, red-stem (see *Erodium cicutarium*)
fir, alpine (see *Abies lasiocarpa*)
fir, balsam (see *Abies balsamea*)
fir, douglas (see *Pseudotsuga menziesii*)
fir, giant (see *Abies grandis*)
fir, lovely (see *Abies amabilis*)
fireweed, tooth coast (see *Erechtites arguta*)
Fragaria sp. (strawberry)
Autographa californica
Trichoplusia ni
Geranium sp. (geranium)
Autographa biloba
Pseudoplusia includens
Trichoplusia ni
geranium (see *Geranium* sp.)
Gladiolus sp. (gladiola)
Autographa biloba
gladiola (see *Gladiolus* sp.)
Glycine max (soybean)
Autoplusia egena
Pseudoplusia includens
goldenrod (see *Solidago* sp.)
Gossypium sp. (cotton)
Autographa californica
Trichoplusia ni
Gossypium hirsutum (upland cotton)
Pseudoplusia includens
grape (see *Vitis* sp.)
grasses (see *Poaceae*)
groundsel (see *Senecio* sp.)
hawksbeard (see *Crepis* sp.)
Hedra sp. (Ivy)
Autographa biloba
Helianthus sp. (sunflower)
Autographa biloba
Trichoplusia ni
Heliotropium sp. (heliotrope)
Autoplusia olivacea
heliotrope (see *Heliotropium* sp.)
Helxine soleirolii (babys' tears)
Autographa biloba
hemlock, western (see *Tsuga heterophylla*)
heronsbill (see *Erodium* sp.)
Hibiscus esculentus (okra)
Pseudoplusia includens
Trichoplusia ni
hollyhock (see *Althaea rosea*)
Hordeum vulgare (barley)
Autographa biloba
Autographa californica
horse brier (see *Smilax rotundifolia*)
horse weed (see *Erigeron canadensis*)
Ipomoea purpurea (common morning glory)
Trichoplusia ni
ivy (see *Hedra* sp.)
ivy, German (see *Senecio mikanioides*)
kale (see *Brassica oleracea*)
Lactuca sp. (wild lettuce)
Trichoplusia ni
Lactuca canadensis
Trichoplusia ni
Lactuca sativa (lettuce)
Anagrapha falcifera
Autographa biloba
Autographa californica
Pseudoplusia includens
Trichoplusia ni
Autographa californica
Pseuchoplusia includens
Trichoplusia ni
lambs-quarters (see *Chenopodium album*)
Lantana sp.
Autoplusia olivacea
Pseudoplusia includens
Larix laricina (tamarack)
Syngrapha alias
larkspur (see *Delphinium* sp.)
Lathyrus odoratus (sweet pea)
Trichoplusia ni

ıettuce (see *Lactuca sativa*)
lettuce, wild (see *Lactuca* sp.)
Lupinus sp. (lupine)
Autographa californica
Trichoplusia ni
lupine (see *Lupinus* sp.)
Lycopersicon esculentum (tomato)
Autographa californica
Pseudoplusia includens
Trichoplusia ni
mallow (see *malva* sp.)
Malva sp. (mallow)
Autoplusia egena
Trichoplusia ni
Marguerite (see *Chrysanthemum frutescens*)
marigold, big (see *Tagetes erecta*)
marigold, pot (see *Calendula officinalis*)
Medicago sativa (alfalfa)
Autographa biloba
Pseudoplusia includens
Trichoplusia ni
melon (see *Cucumis melo*)
Mentha sp. (mint)
Autoplusia egena
Rachiplusia ou
Trichoplusia ni
Mentha arvensis (wild mint)
Plusia aeroides
Mentha spicata (spearmint)
Autoplusia egena
mignonette, common (see *Reseda odorata*)
milkweed (see *Asclepias* sp.)
Mimulus cardinalis (scarlet monkey-flower)
Autographa biloba
Autoplusia olivacea
mint (see *Mentha* sp.)
mint, wild (see *Mentha arvensis*)
monkey-flower, scarlet (see *Mimulus cardinalis*)
morning glory, common (see *Ipomoea purpurea*)
mustard, black (see *Brassica nigra*)
mustard, field (see *Brassica campestris*)
mustard, white (see *Brassica hirta*)
nasturtium, garden (see *Tropaeolum majus*)
nasturtium (see *Tropaeolum* sp.)
Nemophila menziesii (baby blue-eyes)
Autographa californica
nettle, Lyall (see *Urtica lyallii*)
nettle, stinging (see *Urtica dioica*)
Nicotiana glauca (tree tobacco)
Trichoplusia ni
Nicotiana tobaccum (tobacco)
Autographa biloba
Pseudoplusia includens
Rachiplusia ou
Trichoplusia ni
Trichoplusia oxygramma
Nicotiana trigonophylla
Trichoplusia ni
Poppy, California (see *Eschscholzia californica*)
poppy (see *Papaver* sp.)
okra (see *Hibiscus esculentus*)
onion (see *Allium cepa*)
orange, sweet (see *Citrus sinensis*)
paint brush (see *Castilleja* sp.)
Papaver sp. (poppy)
Trichoplusia ni
parsnip, cultivated (see *Pastinaca sativa*)
Pastinaca sataiva (cultivated parsnip)
Trichoplusia ni
pea, garden (see *Pisum sativum*)
pea, sweet (see *Lathyrus odoratus*)
Pectis papposa (chinch weed)
Trichoplusia ni
Pelargonium sp. (storksbill)
Pseudoplusia includens
Persea americana (avocado)
Pseudoplusia includens
Petunia sp. (petunia)
Trichoplusia ni
petunia (see *Petunia* sp.)
Phacelia sp.
Autographa biloba
Phaseolus sp. (beans)
Anagrapha falcifera
Autographa californica
Autoplusia egena
Pseudoplusia includens
Trichoplusia ni
Phaseolus limensis (lima beans)
Autoplusia egena
Autoplusia olivacea
Trichoplusia ni
Phaseolus lunatus (sieva bean)
Trichoplusia ni
Phaseolus vulgaris (kidney beans)
Autographa biloba
Autoplusia egena
Autoplusia olivacea
Trichoplusia ni
Philodendron sp.
Trichoplusia ni
Picea engelmanii (Engelmann spruce)
Syngrapha alias
Syngrapha celsa
Picea glauca (white spruce)
Syngrapha alias
Syngrapha celsa

Picea mariana (black spruce)
Syngrapha alias
Picea rubens (red spruce)
Syngrapha alias
pine, Jack (see *Pinus banksiana*)
pine, western white (see *Pinus monticola*)
Pinus banksiana (Jack pine)
Syngrapha alias
Pinus monticola (western white pine)
Syngrapha alias
Syngrapha celsa
Pisum sativum (garden pea)
Trichoplusia ni
Plantago sp. (plantain)
Anagrapha falcifera
Autographa biloba
Trichoplusia ni
plantain (see *Plantago* sp.)
Poaceae sp. (grasses)
Chrysaspidia putnami
Podocarpus sp.
Autographa californica
pointsettia (see *Euphorbia pulcherrima*)
poplar, balsam (see *Populus balsamifera*)
Populus balsamifera (balsam)
Autographa ampla
Populus tremuloides (American aspen)
Autographa ampla
potato (see *Solanum tuberosum*)
Prunus sp.
Autographa ampla
Pseudotsuga menziesee (Douglas fir)
Syngrapha alias
Syngrapha celsa
puncture weed (see *Tribulus* sp.)
quince, dwarf Japanese (see *Chaenomeles japonica*)
radish (see *Raphanus sativus*)
ragwort, tansy (see *Senecio jacobaea*)
Raphanus sativus (radish)
Autographa californica
Trichoplusia ni
Reseda odorata (common mignonette)
Trichoplusia ni
Rheum sp. (rhubarb)
Autographa californica
rhubarb (see *Rheum* sp.)
safflower (see *Carthamus tinctorius*)
sage (see *Salvia* sp.)
Salix sp. (willow)
Autographa ampla
saltbush (see *Atreplex* sp.)
Salvia leucophylla
Autographa biloba
Autographa californica
Salvia sp. (sage)
Trichoplusia ni
Scrophularia californica (figwort)
Autographa labrosa
sedge (see *Carex* sp.)
Senecio sp. (groundsel)
Autoplusia egena
Autoplusia olivacea
Senecio cineraria (dusty miller)
Autographa californica
Senecio jacobaea (tansy ragwort)
Autographa californica
Autoplusia olivacea
Senecio mikanioides (Germany-ivy)
Trichoplusia ni
service-berry, Pacific (see *Amelanchier florida*)
Shepherdia canadensis
Autographa ampla
Smilax rotundifolia (horse-brier)
Trichoplusia ni
snapdragon (see *Antirrhinum* sp.)
Solanum tuberosum (potato)
Autographa californica
Trichoplusia ni
Solidago sp. (goldenrod)
Pseudoplusia includens
Trichoplusia oxygramma
soybean (see *Glycine max*)
Sparganium sp. (bur-reed)
Chrysaspidia putnami
spearmint (see *Mentha spicata*)
spiderwort (see *Tradescantia fluminensis*)
Spinacea oleracea (spinach)
Autographa californica
Trichoplusia ni
spinach (see *Spinacea oleracea*)
Spiraea salicifolia
Plusia aeroides
spruce, black (see *Picea mariana*)
spruce, Engelmann (see *Picea engelmannii*)
spruce, red (see *Picea rubens*)
spruce, white (see *Picea glauca*)
squashes, autumn & winter (see *Cucurbita maxima*)
squash, zuccini (see *Cucurbita pepo*)
Stachys ajugoides
Autographa biloba
Autographa pasiphaeia
Stachys rigida
Autographa pasiphaeia
storksbill (see *Pelargonium* sp.)
strawberry (see *Fragaria* sp.)
sunflower (see *Helianthus* sp.)
Symphytum sp. (comfrey)
Autoplusia egena
Tagetes erecta (big marigold)
Autoplusia egena
Tagetes erecta (big marigold)
Autoplusia egena
tamarack (see *Larix laricina*)

Taraxacum officinale (common dandelion)
Trichoplusia ni
thistle (see *Cirsium horridulum*)
thoroughwort (see *Eupatorium* sp.)
Thuja plicata (giant cedar)
Syngrapha alias
tobacco (see *Nicotiana tobaccum*)
tobacco, tree (see *Nicotiana glauca*)
tomato (see *Lycopersicon esculentum*)
Tradescantia fluminensis (spiderwort or wandering Jew - in part)
Mouralia tinctoides
Pseudoplusia includens
Trapaeolum sp. (nasturtium)
Rachiplusia ou
Trapaeolum majus (garden nasturtium)
Trichoplusia ni
Tribulus sp. (puncture weed)
Trichoplusia ni
Trifolium sp. (clover)
Rachiplusia ou
Trichoplusia ni
Trifolium incarnatum (crimson clover)
Autographa biloba
Triticum aestivum (wheat)
Autographa californica
Rachiplusia ou
Tsuga heterophylla (western hemlock)
Syngrapha alias
Syngrapha celsa
turnip (see *Brassica rapa*)
Urtica dioica (stinging nettle)
Abrostola urentis
Urtica lyallii (Lyall nettle)
Abrostola urentis
Anagrapha falcifera
Vaccinium macrocarpon (American cranberry)
Anagrapha falcifera
Verbena sp. (verbena)
Autographa biloba
Autoplusia egena
verbena (see *Verbena* sp.)
Viburnum sp.
Anagrapha falcifera
Viburnum cassinoides (withe-rod)
Autographa ampla
Vigna sinensis (cowpea)
Trichoplusia ni
Vitis sp. (grape)
Autographa californica
wandering Jew (see *Tradescantia fluminensis* & *Zebrena pendula*)
watermelon (see *Citrullus vulgaris*)
wheat (see *Triticum aestivum*)
willow (see *Salix* sp.)
withe-rod (see *Viburnum cassinoides*)
Zea mays (corn)
Anagrapha falcifera
Trichoplusia ni
Zebrina pendula (wandering Jew - in part)
Mouralia tinctoides
Pseudoplusia includens

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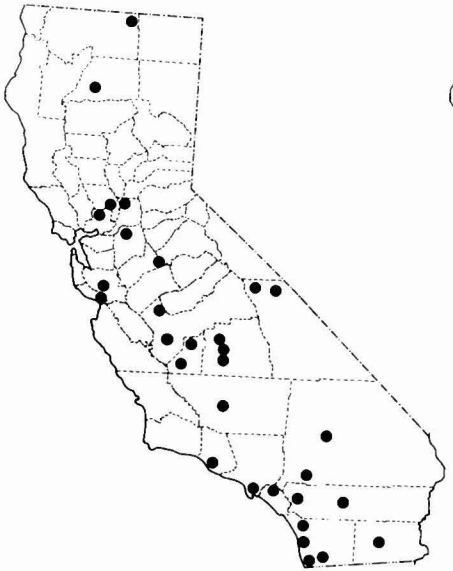
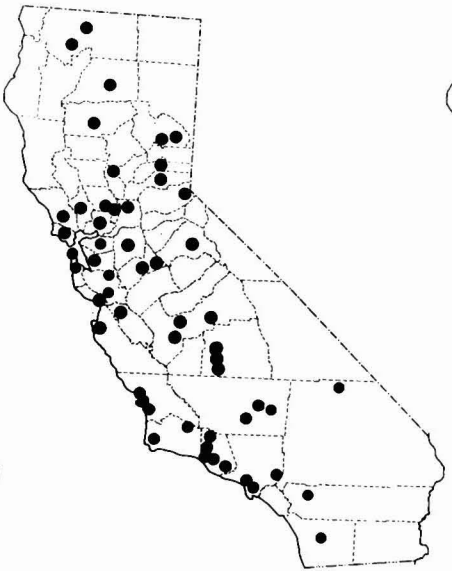
The following article appeared while the present paper was in preparation and includes color photographs of eight species: *Trichoplusia ni, Pseudoplusia includens, Rachiplusia ou, Autographa biloba, A. precationis, A. californica, Autoplusia egena* and *Anagrapha falcifera.*

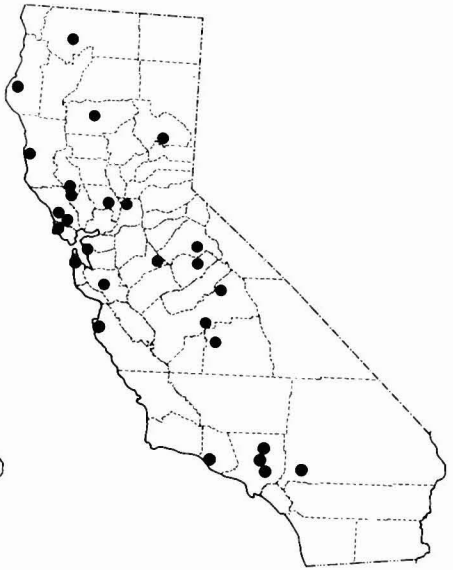
Eichlin, Thomas D., 1975. Some Looper Moth Pests of Garden and Greenhouse. Nat. Pest Cont. Operator's News, 35(6): 12-15.



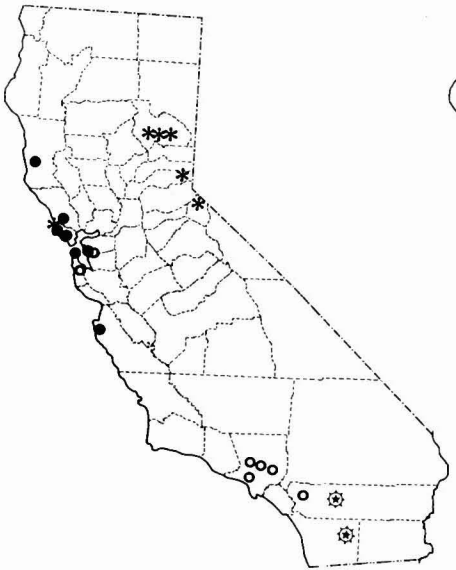
Map 1, *Trichoplusia ni*



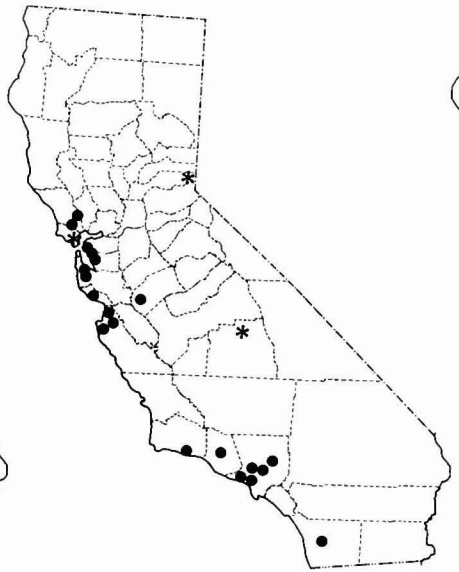
Map 2, *Autographa californica*



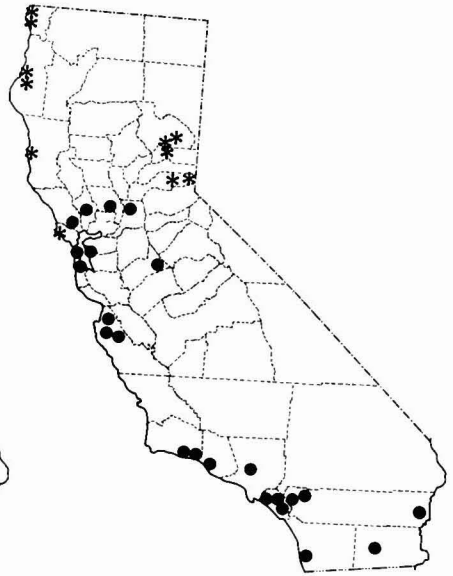
Map 3, *Autographa pasiphaea*



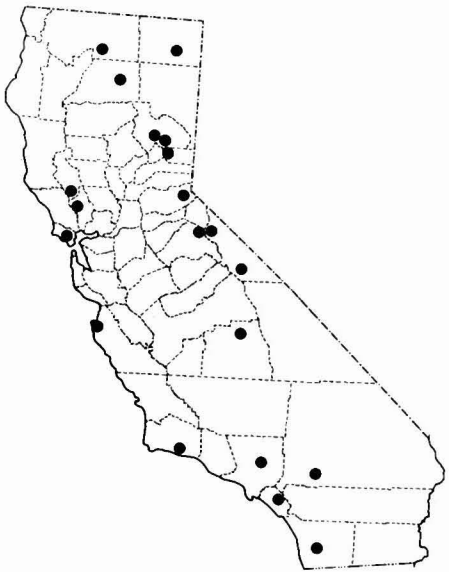
Map 4, *Abrostola parvula* (⊛)
Mouralia tinctoides (o)
Autographa labrosa (●)
Autographa metallica (✻)



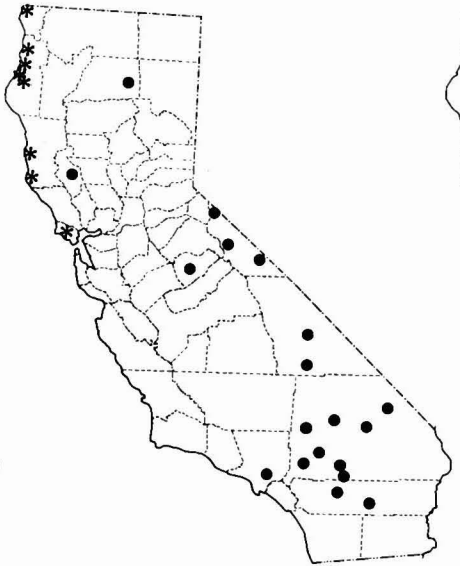
Map 5, *Autoplusia olivacea* (●)
Autographa pseudogamma (✻)



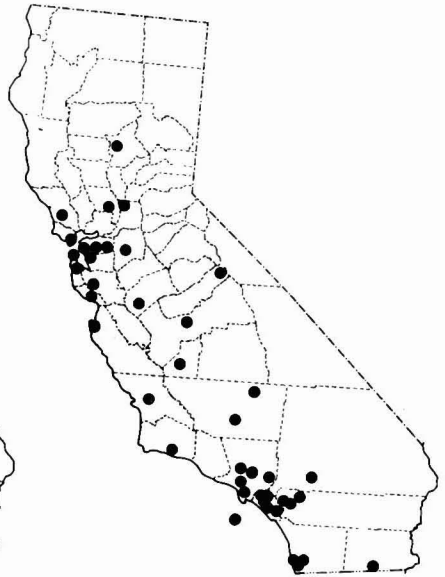
Map 6, *Autoplusia egena* (●)
Autographa ampla (✻)



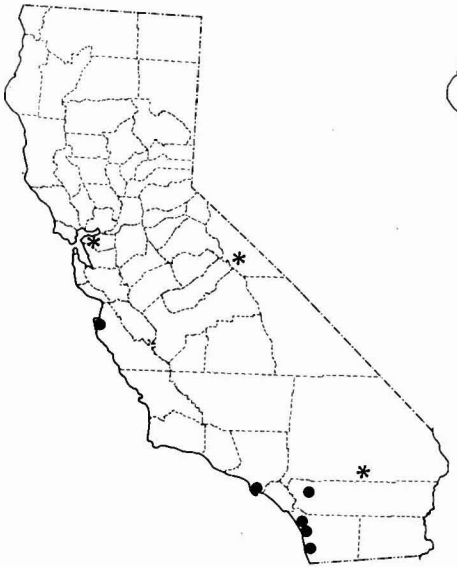
Map 7, *Pseudeva palligera*



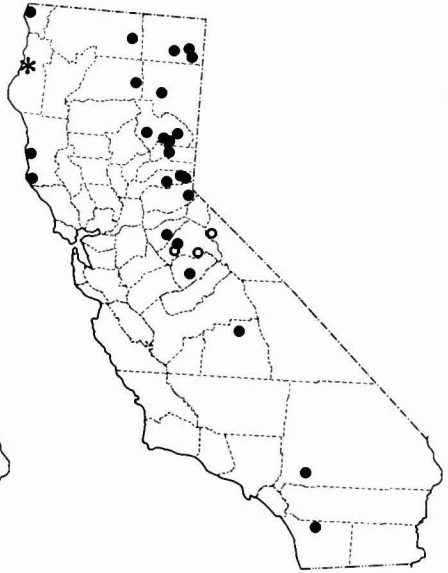
Map 8, *Adeva albavitta* (●)
Autographa corusca (*)



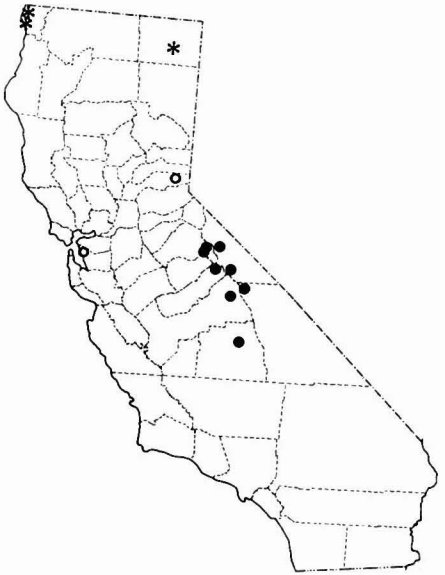
Map 9, *Autographa biloba*



Map 10, *Pseudoplusia includens* (●)
Rachiplusia ou (✻)



Map 11, *Syngrapha alias* (✻)
Syngrapha celsa sierrae (●)
Syngrapha alticola (o)



Map 12, *Anagrapha falcifera* (o)
Caloplusia ignea (●)
Chrysaspidia putnami (✻)

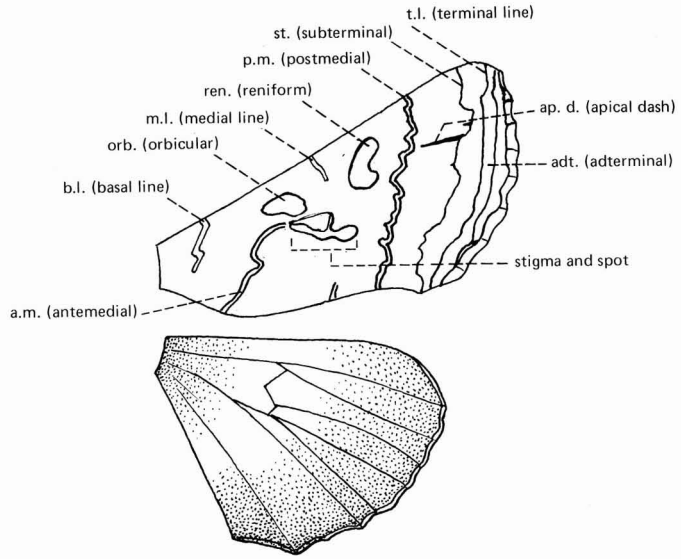


Fig. 1. Adult wing maculation in *Plusiinae*.

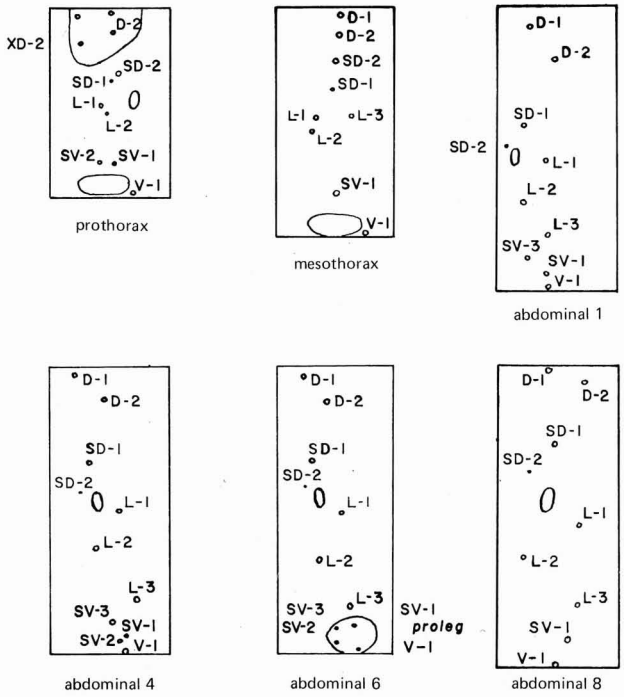


Fig. 2. Setal diagrams of *Autographa californica*.

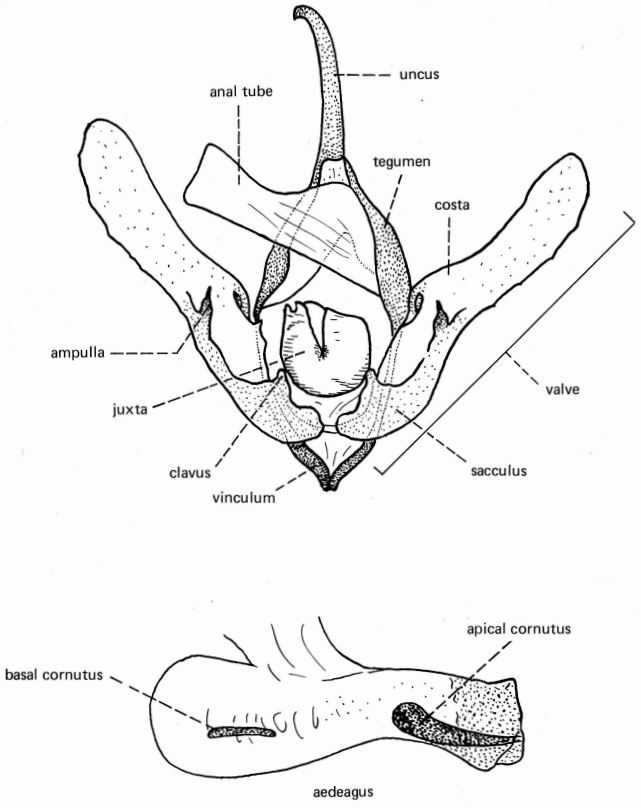


Figure 3, male genitalia of *Syngrapha celsa*.

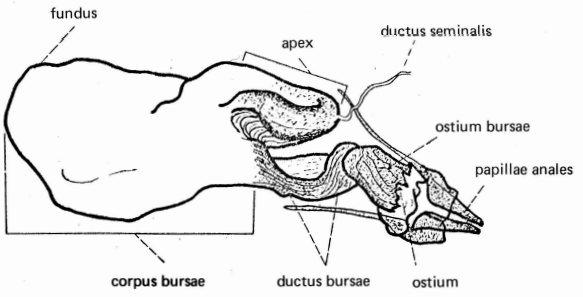
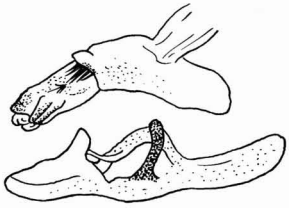


Figure 4, female genitalia of *Caloplusia ignea*.



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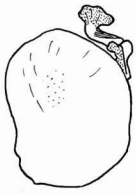

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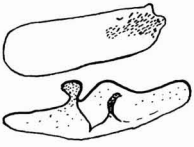

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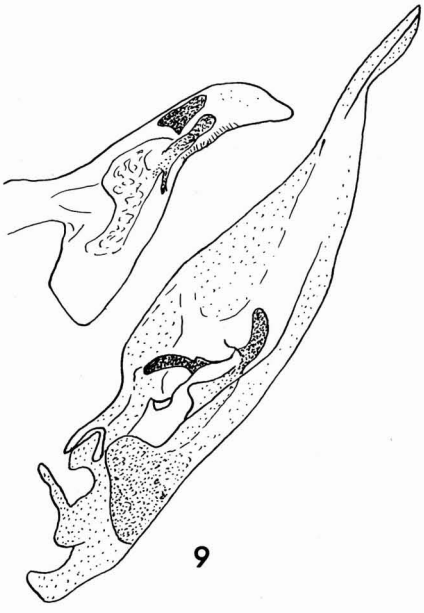

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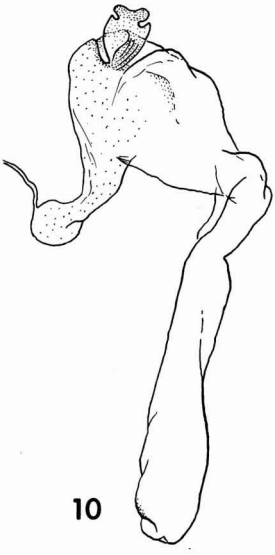

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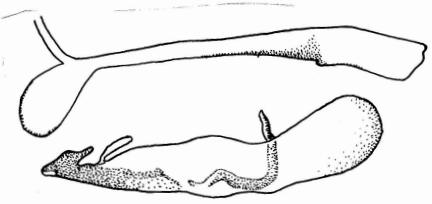
Figures 5-10, Male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 5-6, *Abrostola urentis.* Figs. 7-8, *A. parvula.* Figs. 9-10, *Mouralia tinctoides.*



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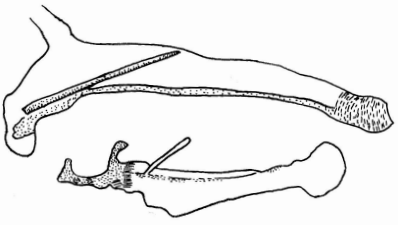

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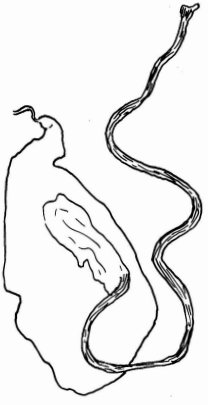

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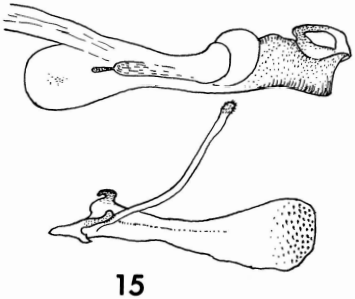

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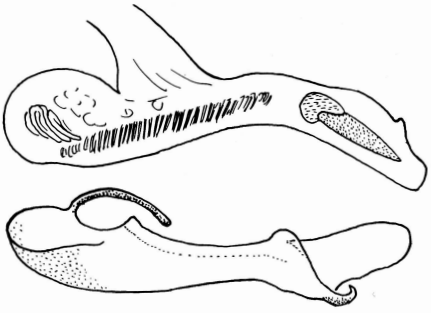
Figures 11-16, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 11-12, *Trichoplusia ni.* Figs. 13-14, *T. oxygramma.* Figs. 15-16, *Pseudoplusia includens.*



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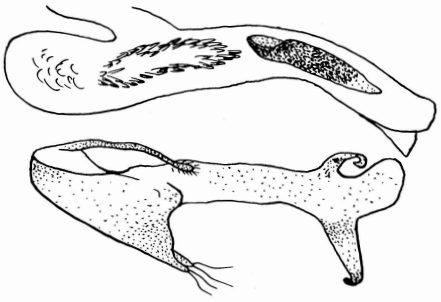

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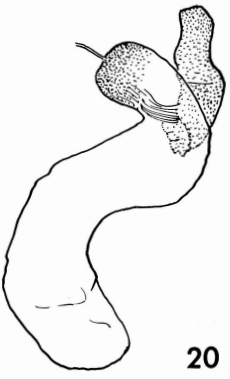

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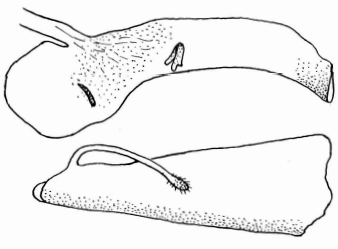

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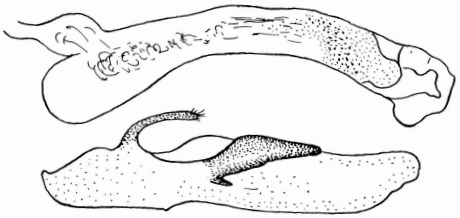
Figures 17-22, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 17-18, *Autoplusia egena*. Figs. 19-20, *A. olivacea*. Figs. 21-22, *Rachiplusia ou*.



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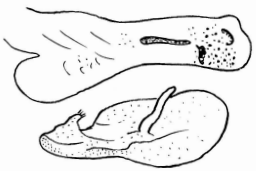

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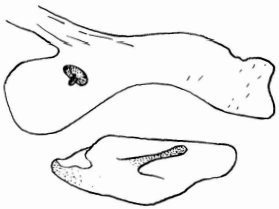

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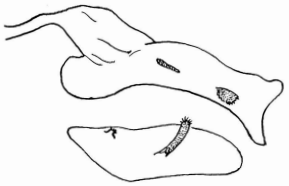
Figures 23-28, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 23-24, *Plusia aeroides*. Figs. 25-26, *Polychrysia morigera*. Figs. 27-28, *Adeva albavitta*.



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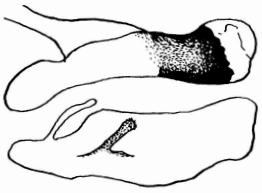

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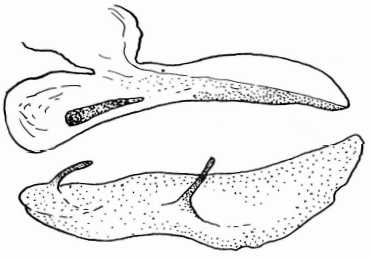

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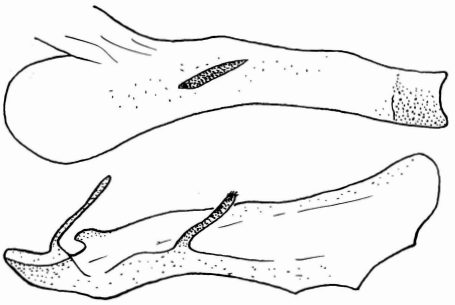
Figures 29-34, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 29-30, *Pseudeva palligera*. Figs. 31-32, *Autographa biloba*. Figs. 33-34, *Autographa californica*.



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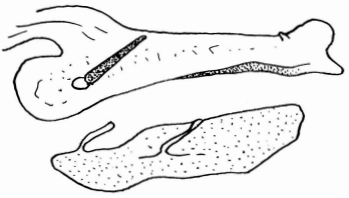

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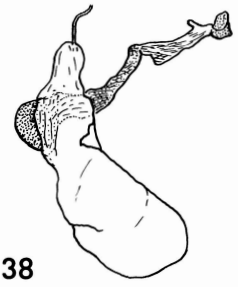

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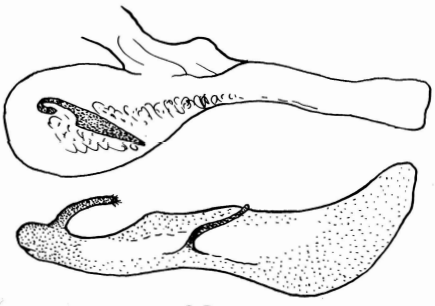

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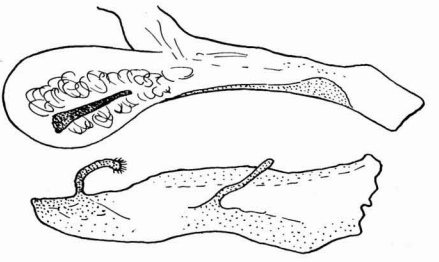
Figures 35-40, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 35-36, *Autographa pseudogamma*. Figs. 37-38, *A. Pasiphaea*. Figs. 39-40, *A. metallica*.



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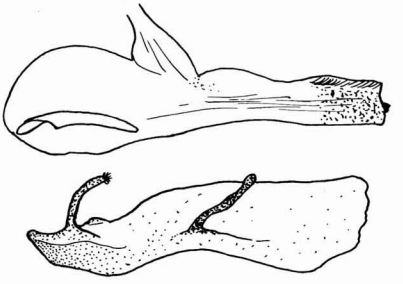

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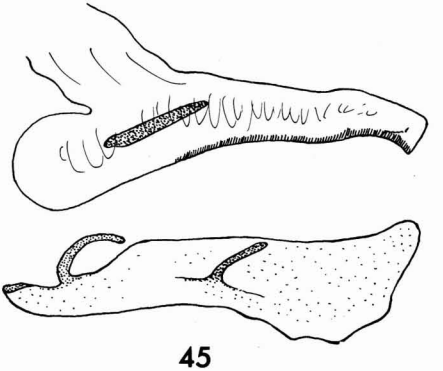

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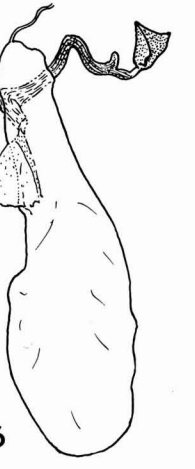

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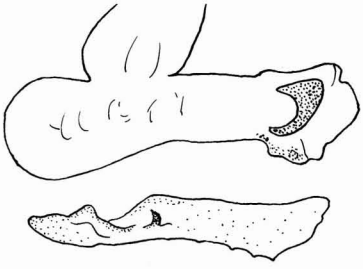
Figures 41-46, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 41-42, ***Autographa corusca***. Figs. 43-44, *A. labrosa*. Figs. 45-46, *A. ampla*.



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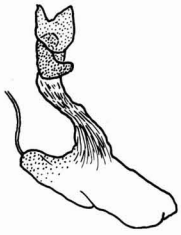

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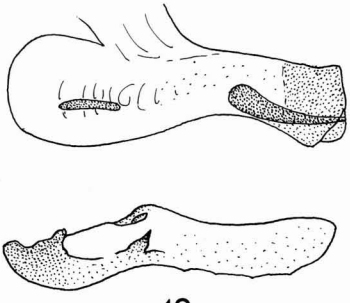

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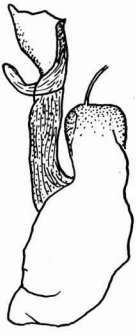

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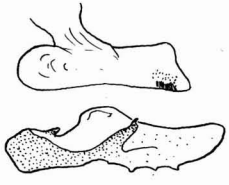

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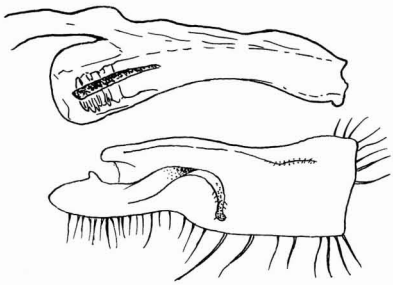
Figures 47-52, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 47-48, *Syngrapha alias.* Figs. 49-50, *S. celsa.* Figs. 51-52, *S. alticola.*



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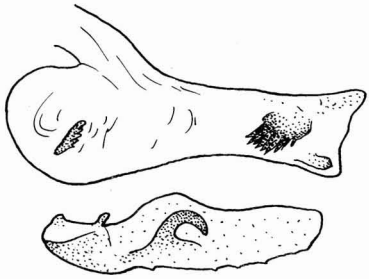

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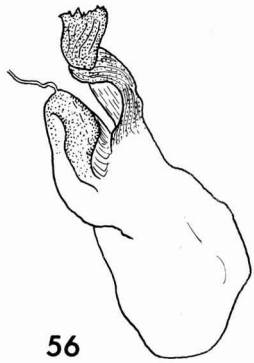

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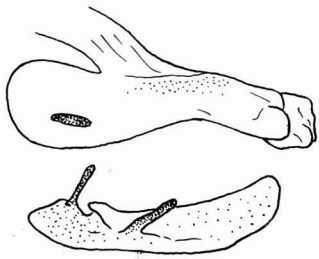

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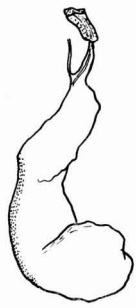

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Figures 53-58, male genitalia (valve, aedeagus), female genitalia (ovipositor removed). Figs. 53-54, *Anagrapha falcifera.* Figs. 55-56, *Caloplusia ignea.* Figs. 57-58, *Chrysaspidia putnami.*

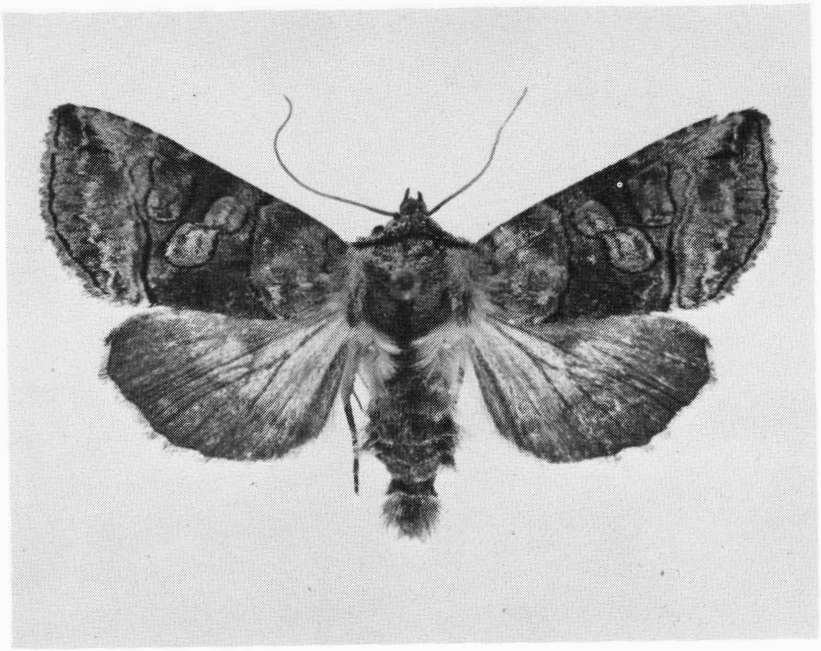

Fig. 59 *Abrostola urentis.*

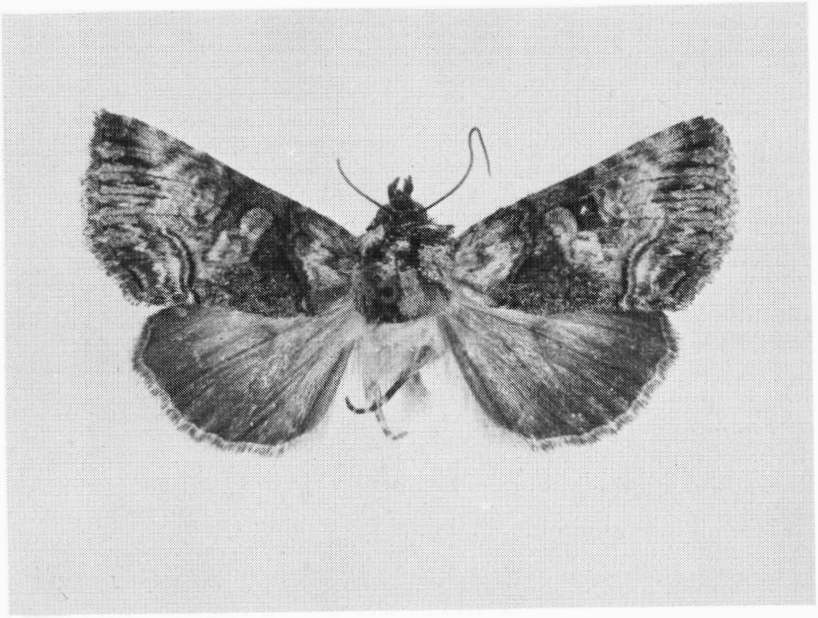

Fig. 60 *A. parvula.*

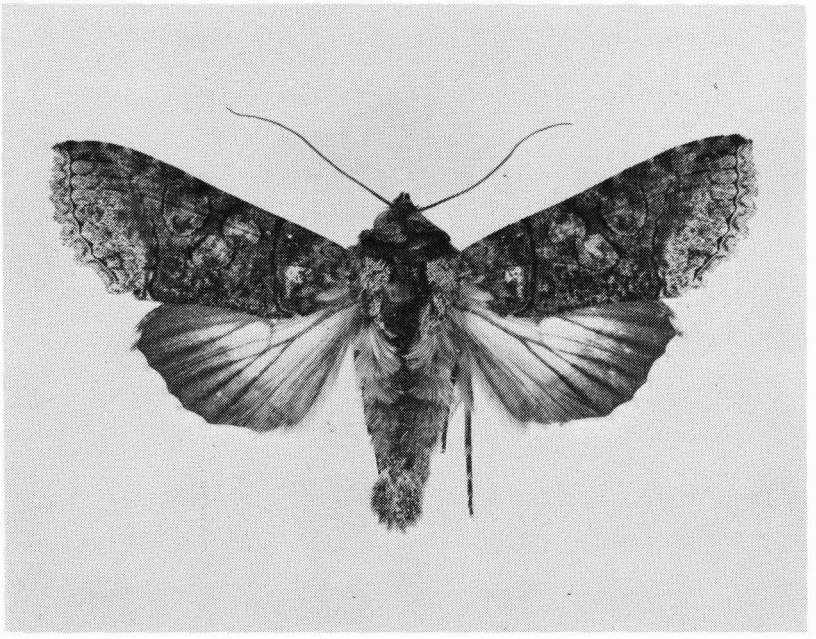

Fig. 61 *Mouralia tinctoides.*

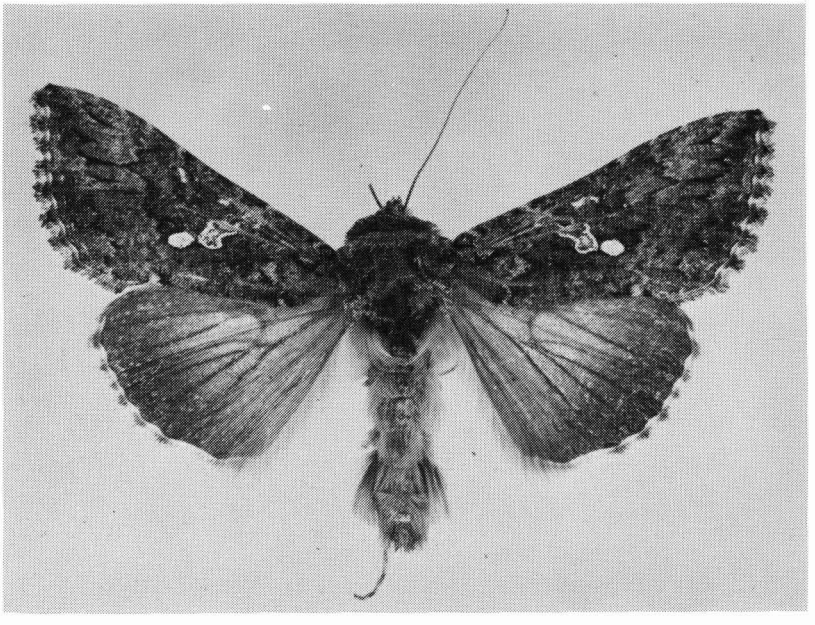

Fig. 62 *Trichoplusia ni.*

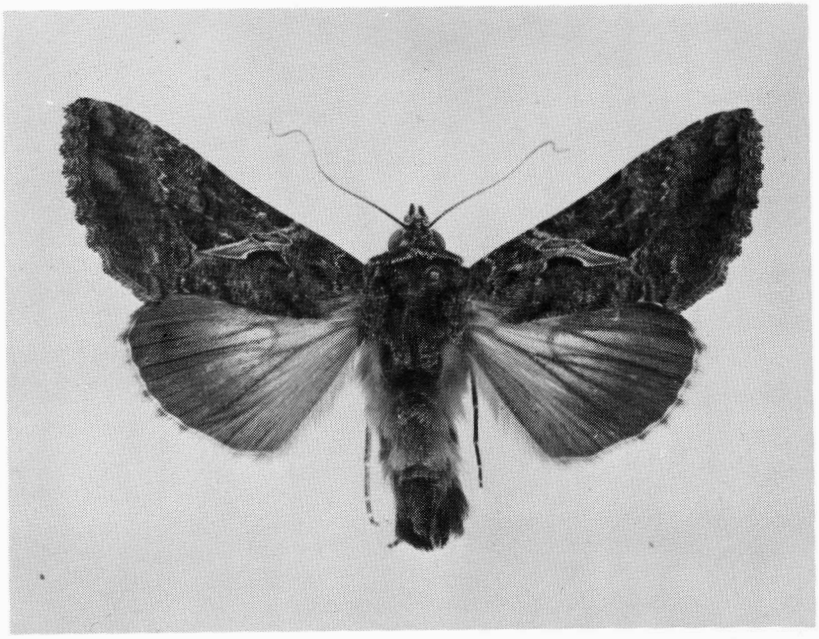

Fig. 63 *Trichoplusia oxygramma*

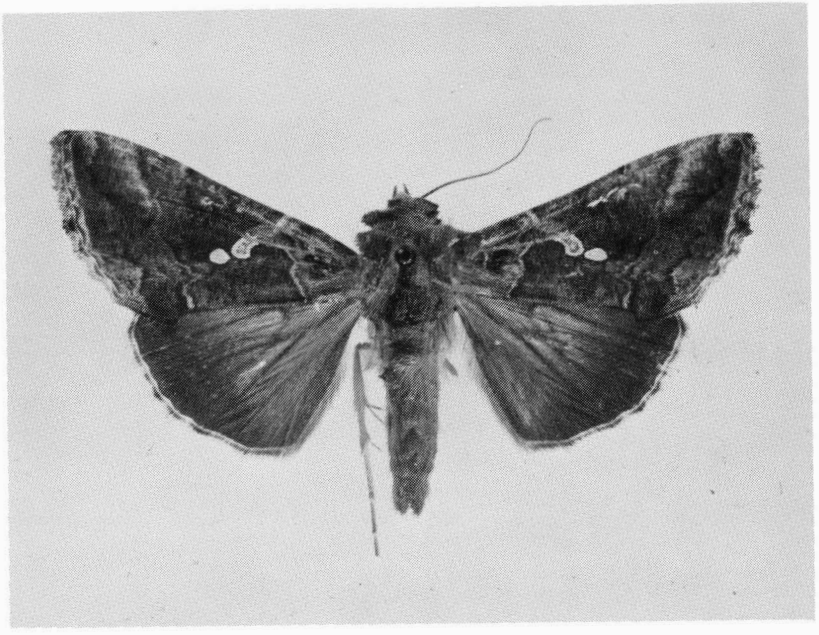

Fig. 64 *Pseudoplusia includens.*

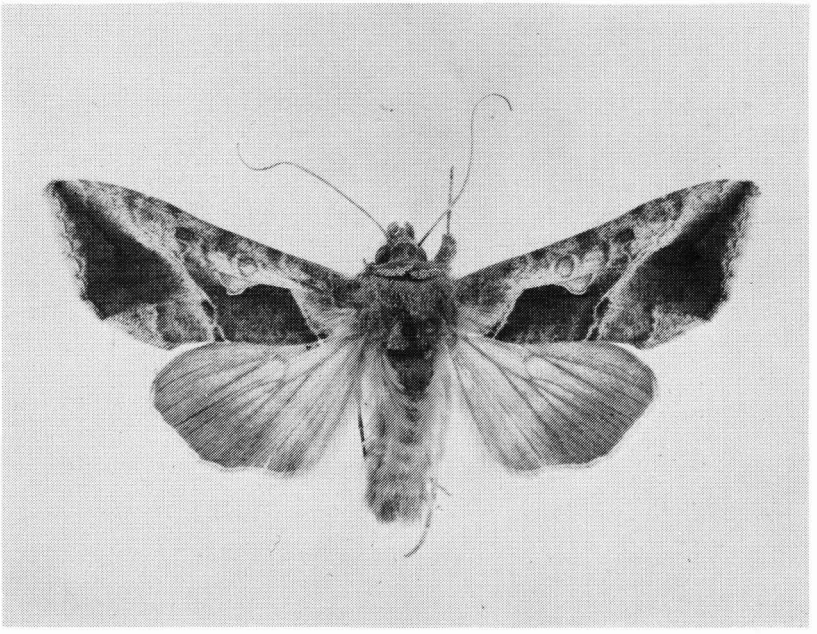

Fig. 65 *Autoplusia egena.*

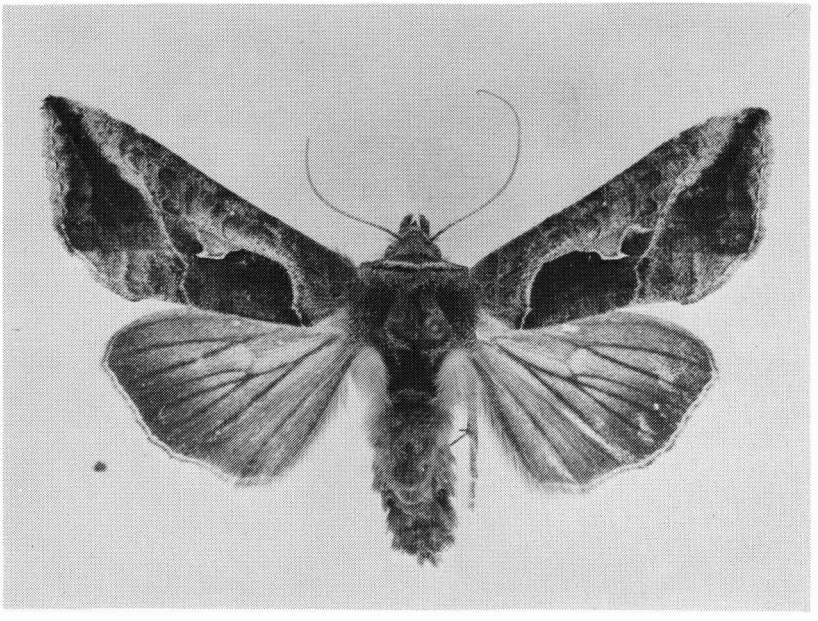

Fig. 66 *A. olivacea.*

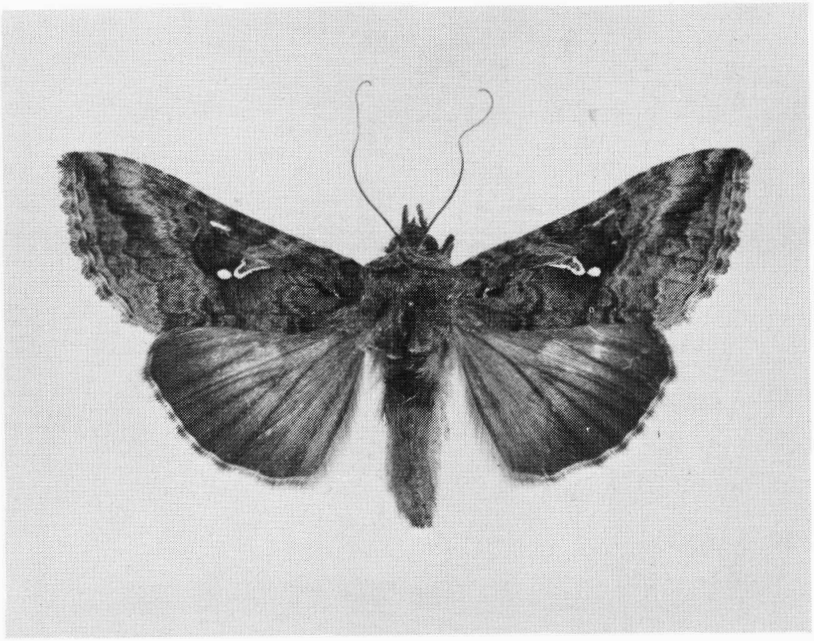

Fig. 67 *Rachiplusia ou.*

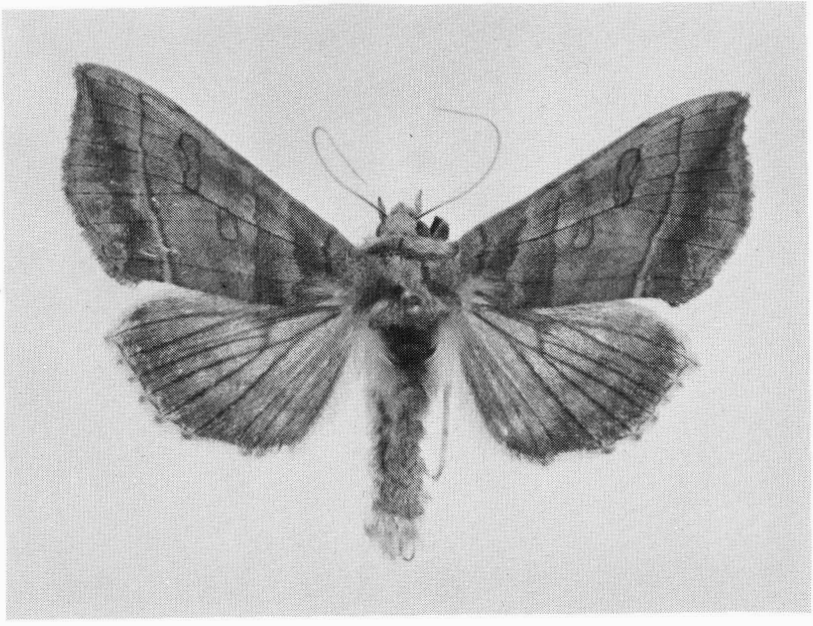

Fig. 68 *Plusia aeroides.*

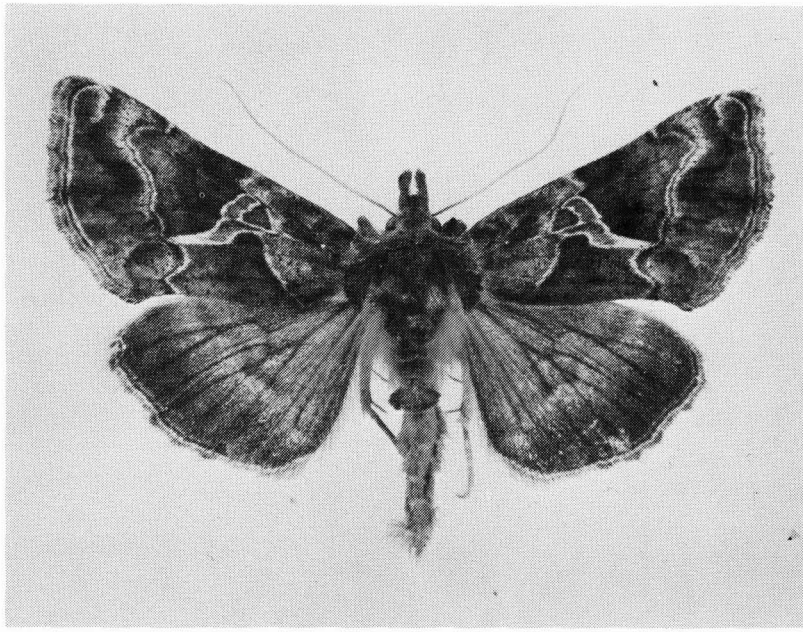

Fig. 69 *Polychrisia morigera.*

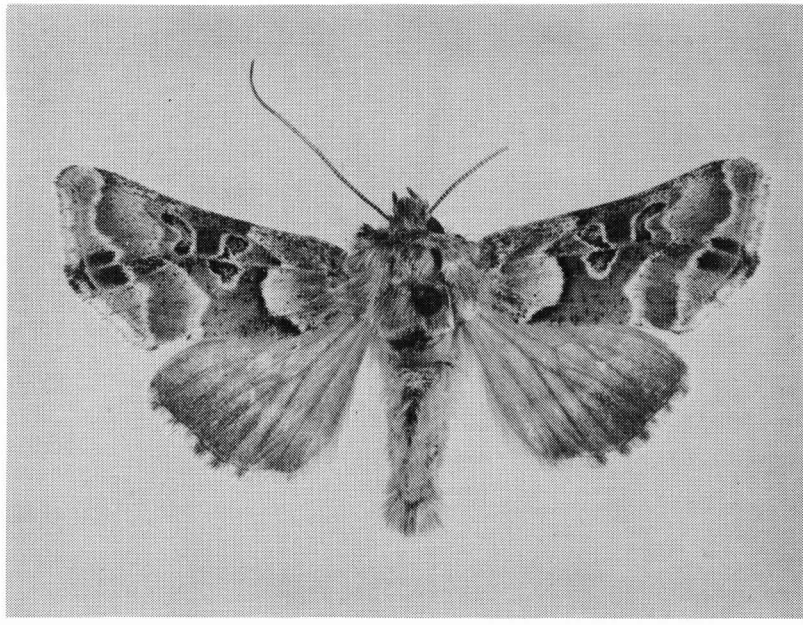

Fig. 70 *Adeva albavitta.*

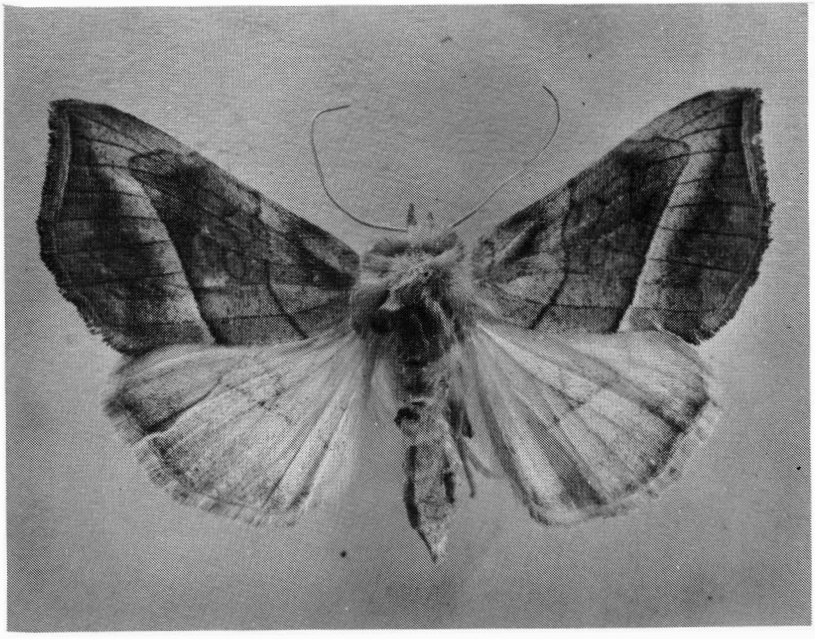

Fig. 71 *Pseudeva palligera.*

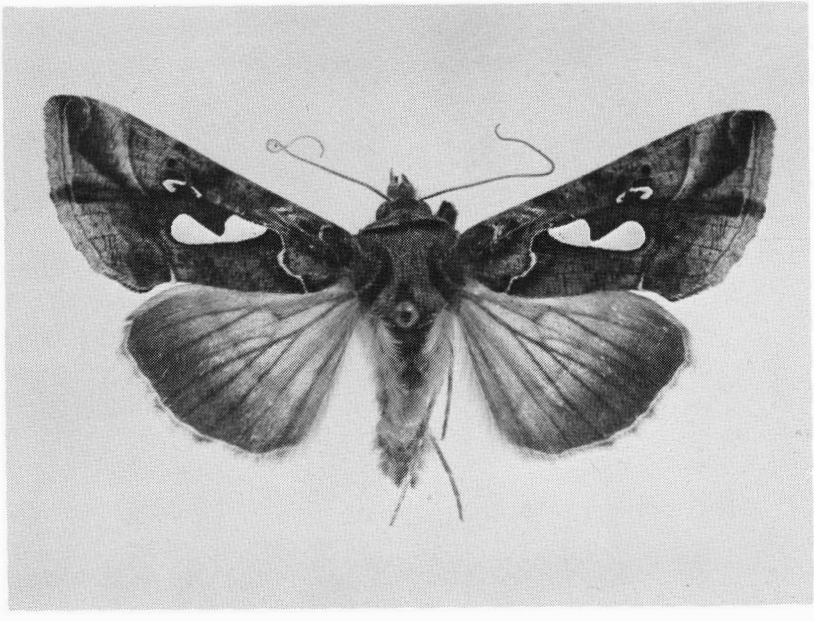

Fig. 72 *Autographa biloba.*

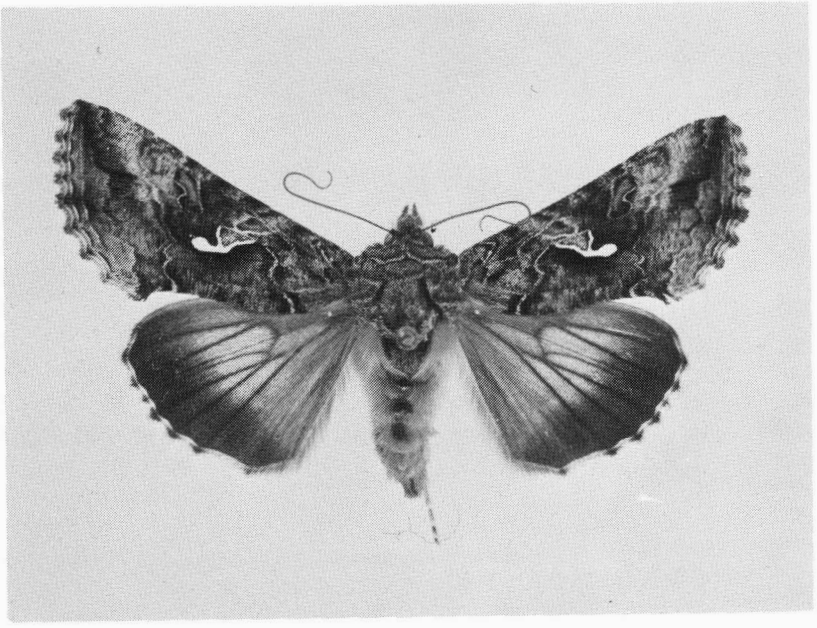

Fig. 73 *Autographa californica*

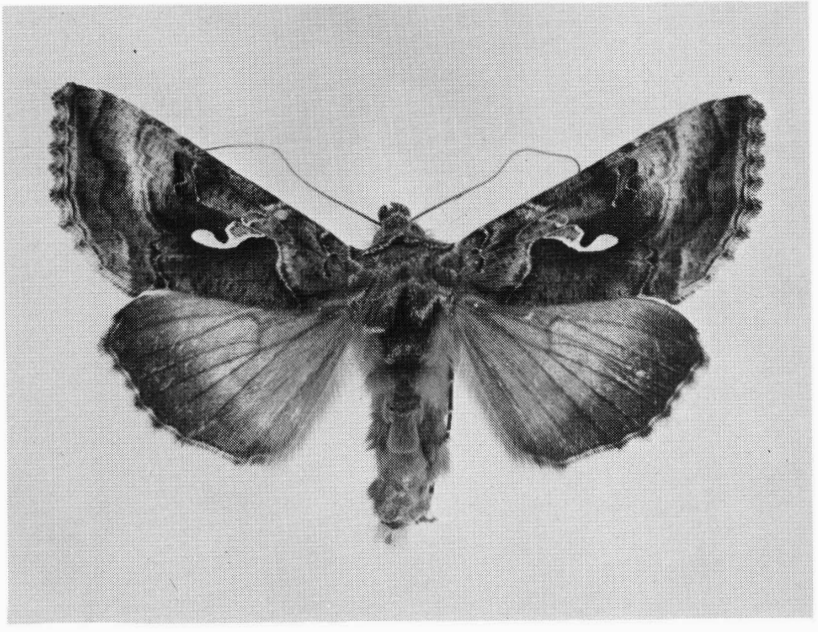

Fig. 74 *A. pseudogamma.*

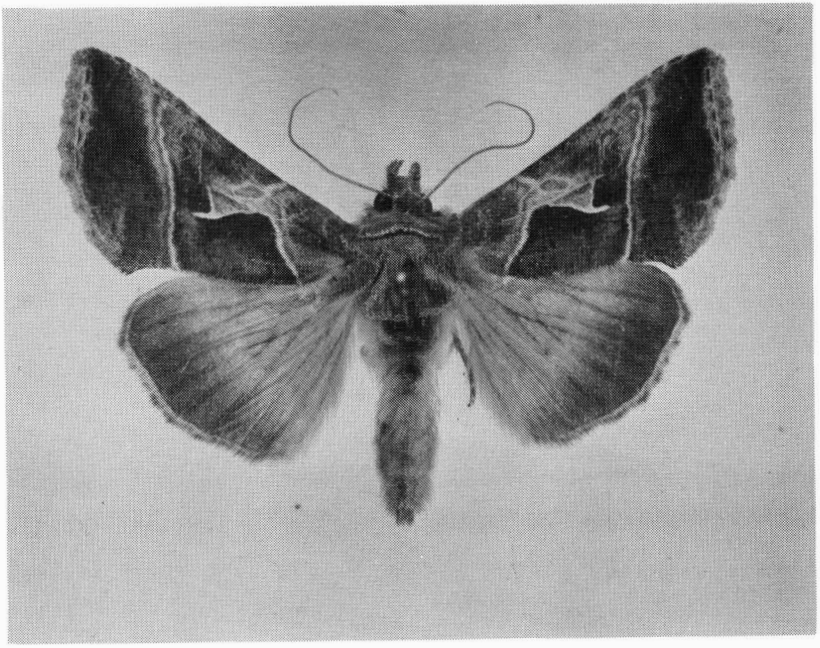

Fig. 75 *Autographa pasiphaea.*

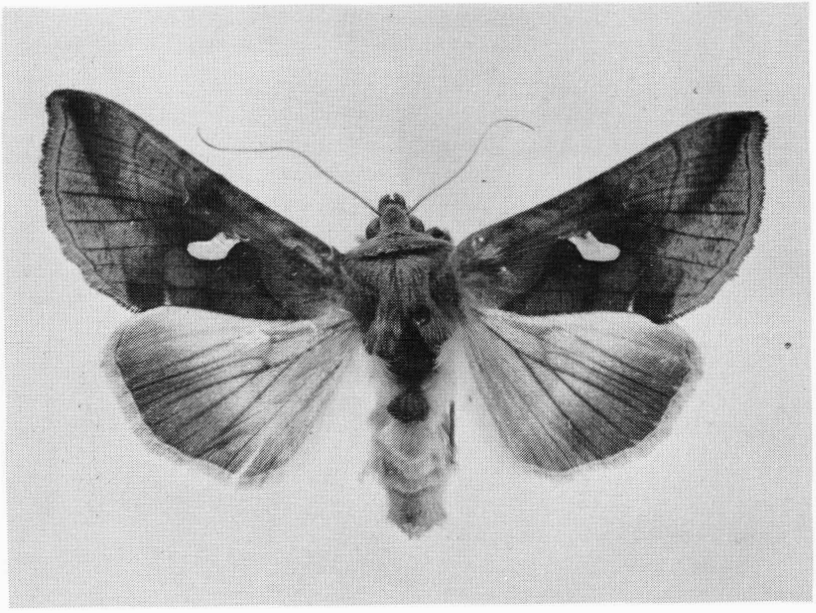

Fig. 76 *A. metallica.*

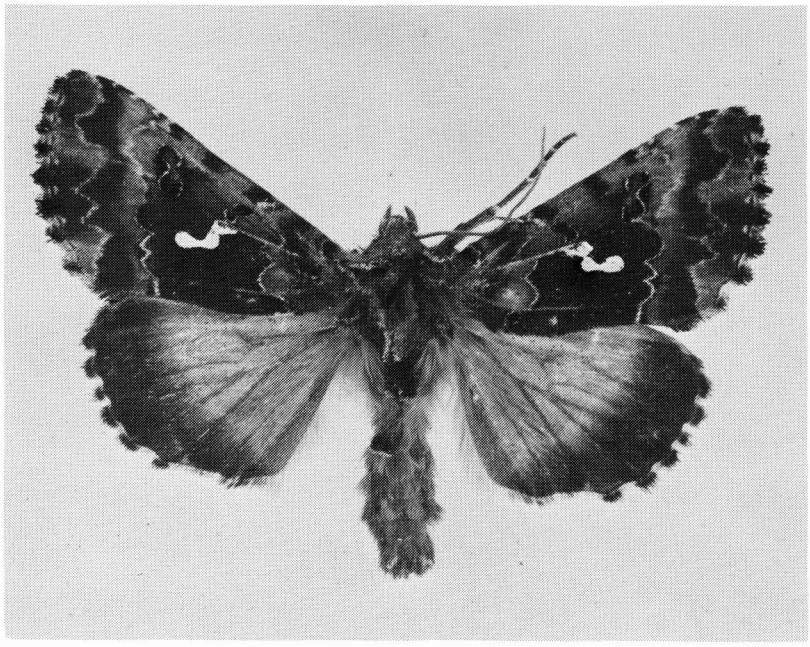

Fig. 77 *Autographa corusca*

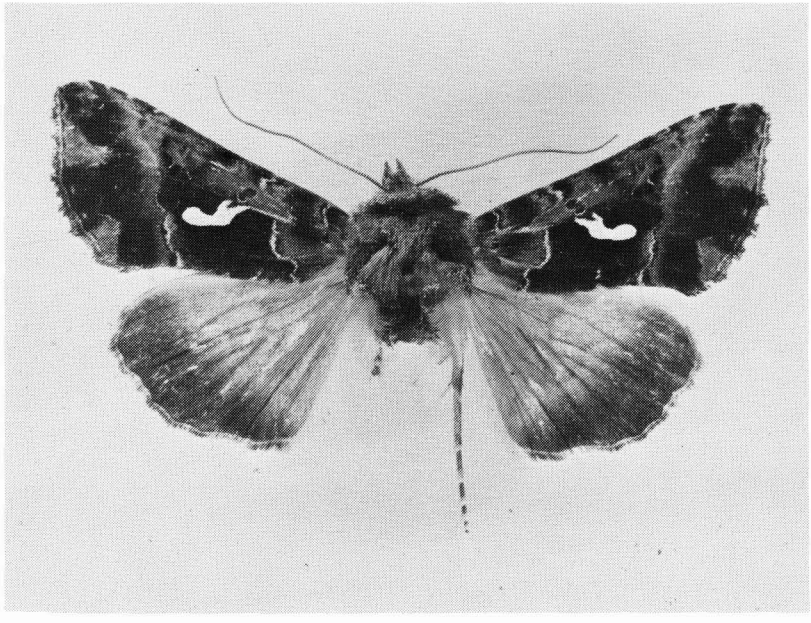

Fig. 78 *A. labrosa.*

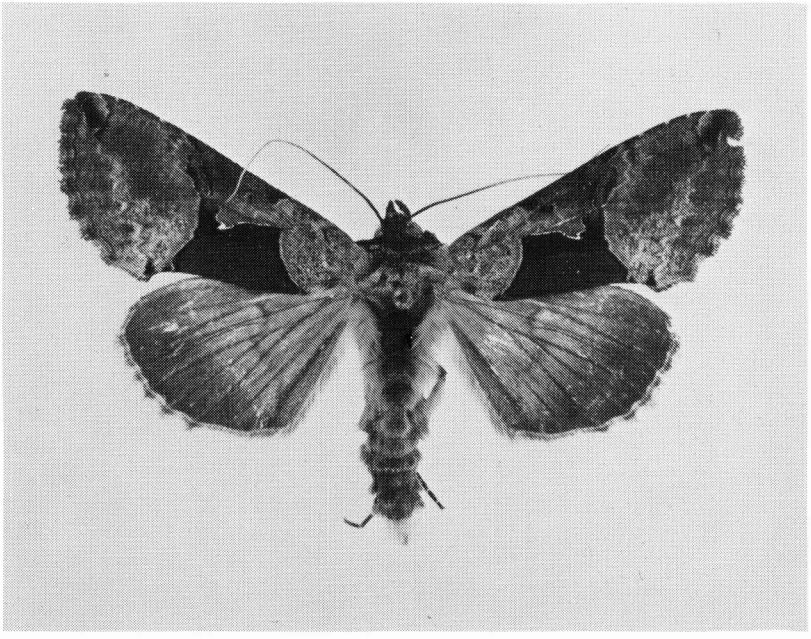

Fig. 79 *Autograqha ampla*

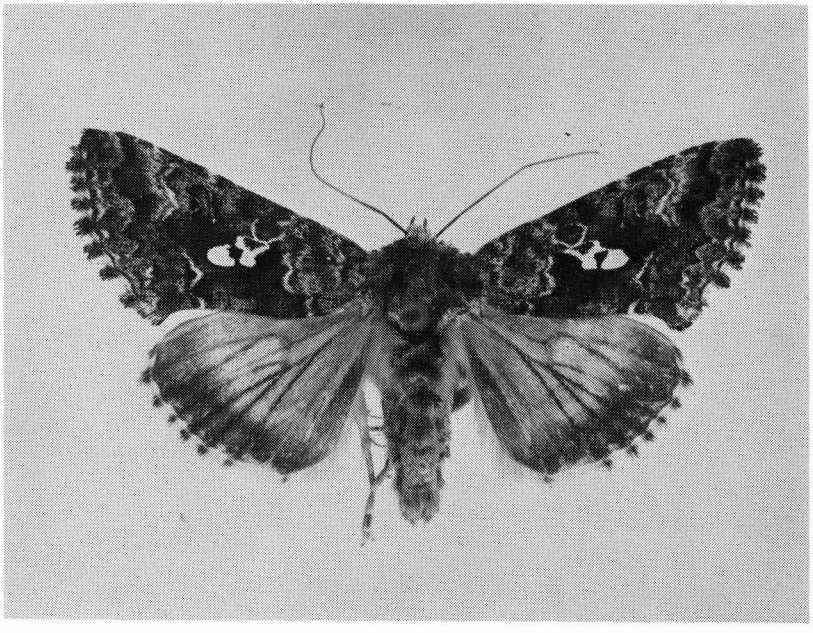

Fig. 80 *Syngrapha alias.*

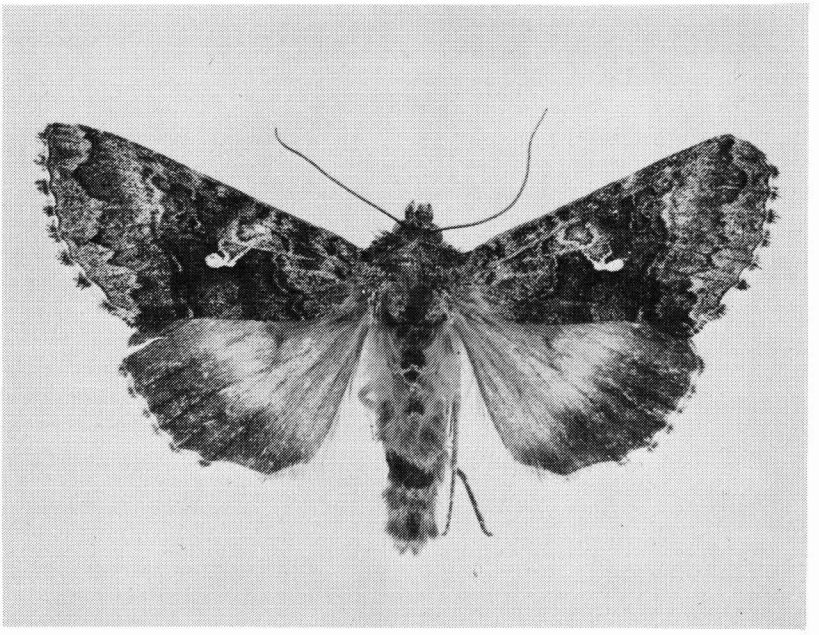

Fig. 81 *Syngrapha celsa*

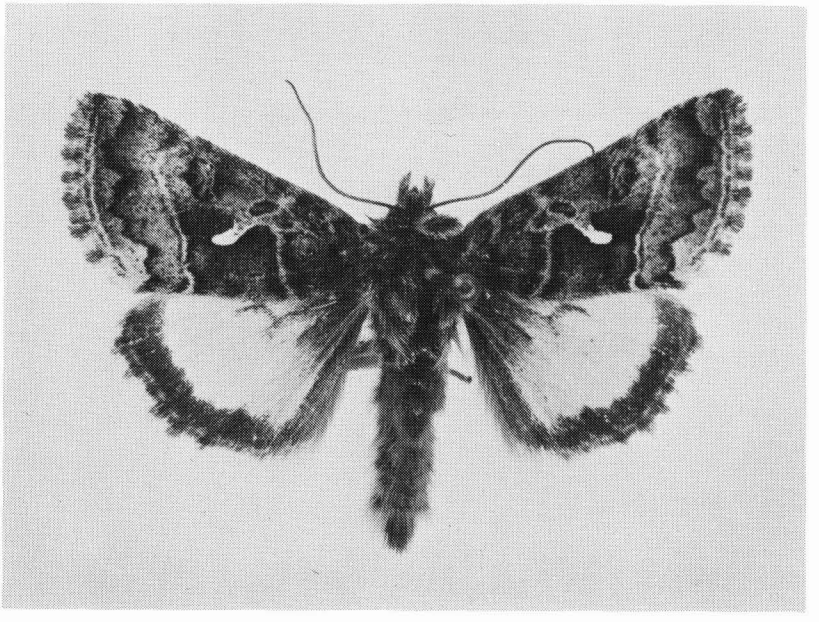

Fig. 82 *S. alticola.*

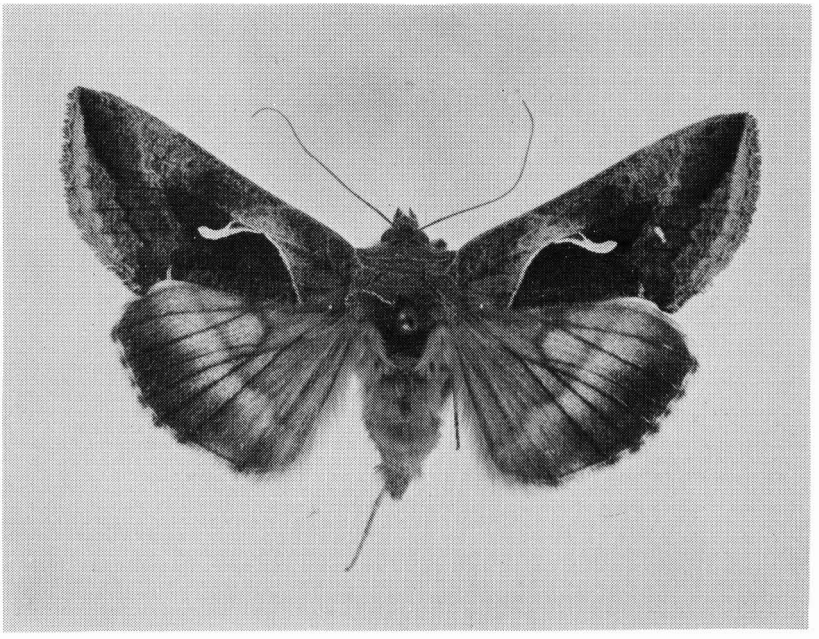

Fig. 83 *Anagrapha falcifera.*

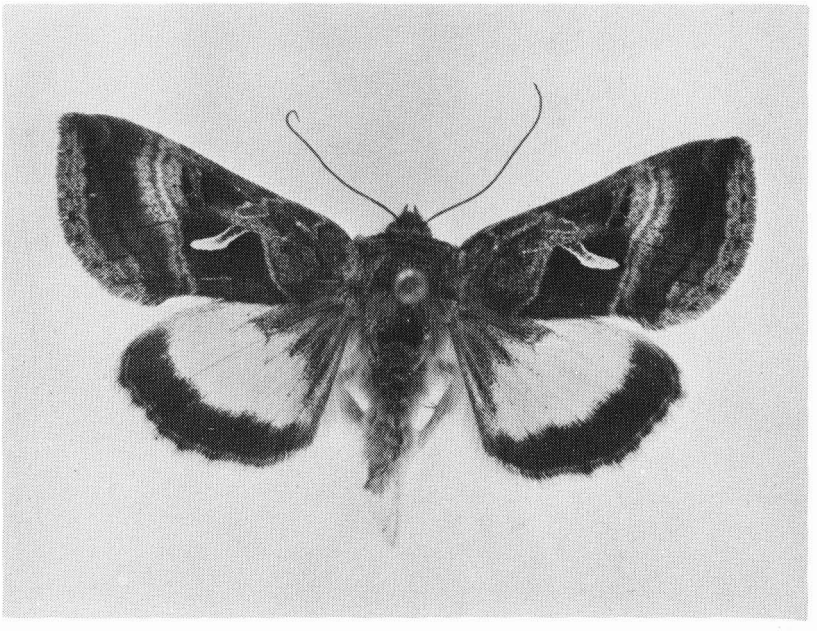

Fig. 84 *Caloplusia ignea.*

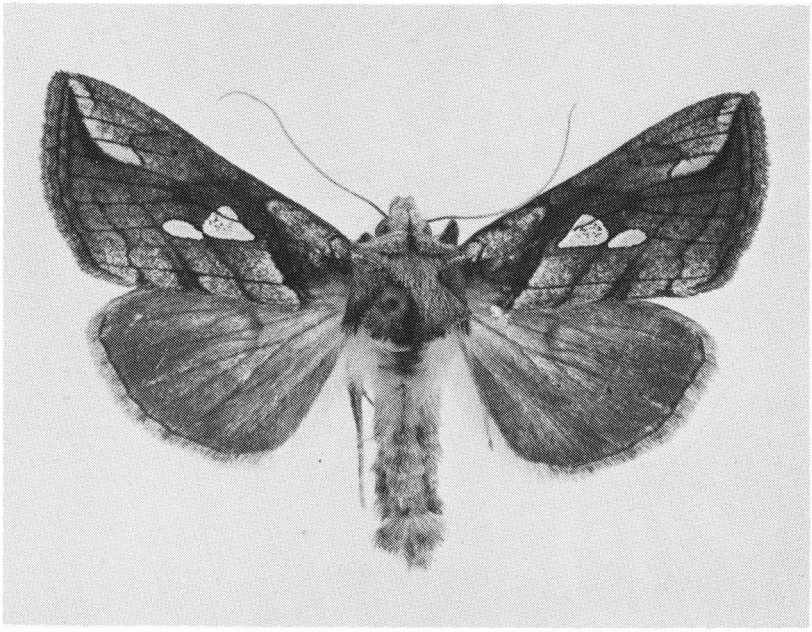

Fig. 85 *Chrysaspidia putnami.*

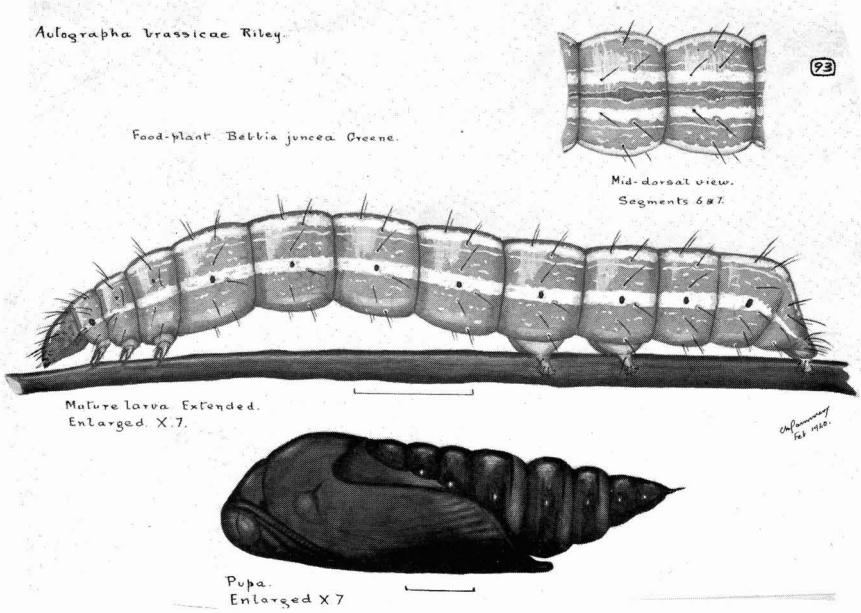

Fig. 86 *Trichoplusia ni.*

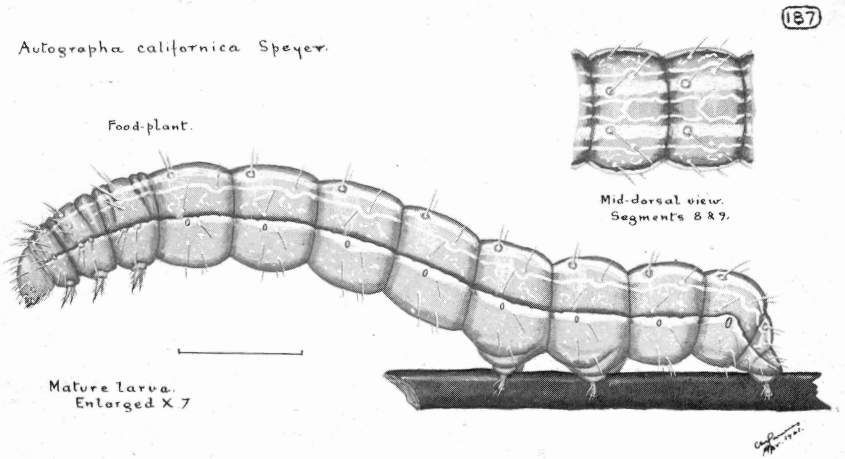

Fig. 87 *Autographa californica.*

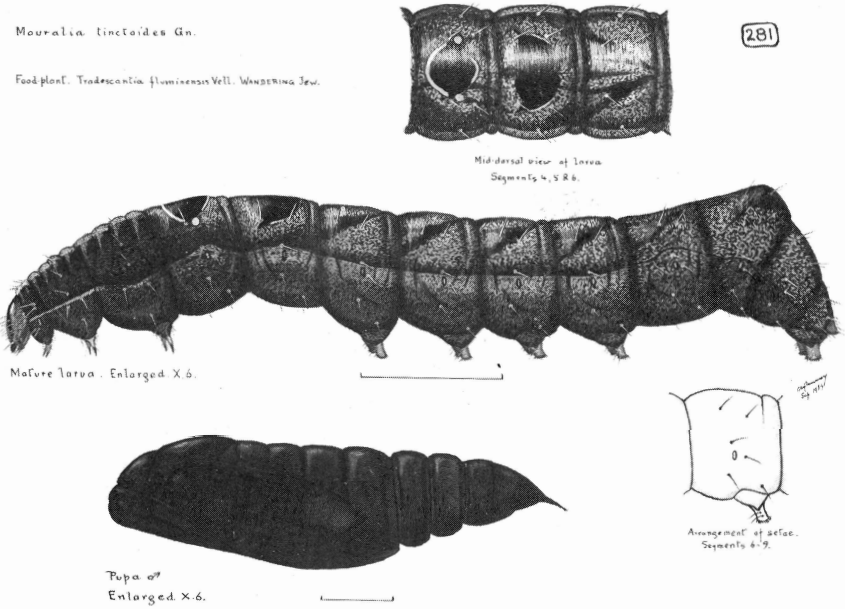

Fig. 88 *Mouralia tinctoides.*

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DR. THOMAS D. EICHLIN:—

Dr. Thomas D. Eichlin has been employed by the California Department of Food and Agriculture for the last two years as a Systematic Entomologist. His area of specialization and responsibility is the Lepidoptera. His particular interest is the systematics of larval and adult Microlepidoptera. In addition to studies on plusiine noctuids he is also actively researching the taxonomy and biosystematics of the Sesiidae of the world.

Tom was born and raised in Easton, Pennsylvania. His wife's name is Kathryn, and they have one son, Eric. He received his B.S. degree in Education at Indiana State University, Indiana, Pa. He taught in the secondary schools in Easton; Miami, Florida; and Lafayette, Alabama, but with a three year interruption in the Army Security Agency, a year and one-half of this served in Okinawa. He attended graduate school at Auburn University, Alabama, where he received the M.S. and Ph.D. degrees in Systematic Entomology with minors in Zoology and Biochemistry. He did postgraduate work as a Research Fellow at the Smithsonian Institution and remained there for a time on grant funds as a Presidential Intern. Before coming to Sacramento Dr. Eichlin had a temporary appointment as Special Assistant to the Environmental Protection Agency.